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July 31, 1958

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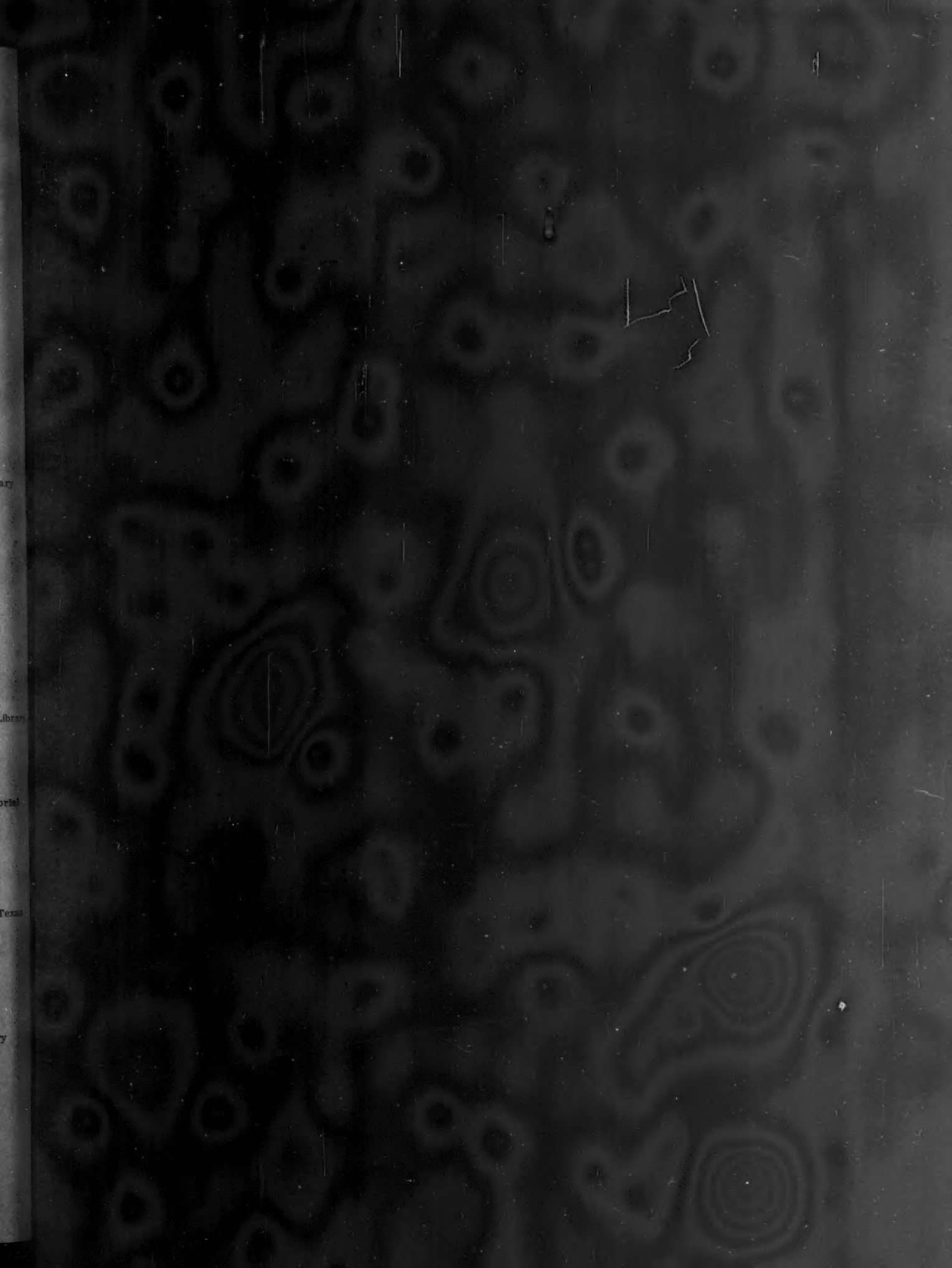

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ERRATA

NSA Vol. 12, No. 1, p. 35. In abstract 299 Omurtage Dimitrov should be Omourtage Dimitrov.

NSA Vol. 12, No. 2 Suppl. p. 238. In abstract 2113, F. W. Kunz should be E. W. Kunz.

NSA Vol. 12, No. 6, p. 488. In abstract 4350, B. Ferrari should be F. Ferrari.

NSA Vol. 12, No. 6, p. 504. In abstract 4486, H. L. McMurray should be H. L. McMurry.

NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 14 July 31, 1958

GENERAL

8910
INSURANCE POSSIBILITIES AGAINST ATOMIC HAZARDS. F. Cincotti. Energia nucleare (Milan) 5, 265-8(1958) Apr. (In Italian)

Insurance companies are at present most concerned with the problems connected with a suitable financial protection of atomic industries personnel. In this paper Francesco Cincotti, director of the Italian Assicurazioni Generali Insurance Company, states in detail the several insurance possibilities offered nowadays against the various kinds of atomic hazards. (auth)

Atomic Power

Refer also to abstract 9458.

8911
THE LENIN PRIZES FOR THE CREATION OF THE FIRST ATOMIC POWER STATION. Yu. K. (K. Yu.). Atomnaya Energiya 3, No. 8, 87-90(1957).

For the construction, building, and successful initial operation of the first Russian Nuclear Electric Power Station the scientists D. J. Blokhintsev, N. A. Dollezhal', A. K. Krasin, and V. A. Malykh were awarded the Lenin Prize. These four scientists were the heads of the very numerous team which coöperated in establishing the nuclear electric power station. Part of the difficulties which had to be overcome during the stage of projecting was described. In many cases it was possible to check theoretically computed values in the reactor RFT. As particularly good solutions the fuel channel and the fuel elements are mentioned which, at a temperature of 300°C and a neutron flux of $\sim 10^{13}$ n/cm^2/sec, give a thermal current of 2.10^{16} kcal/m^2 h. (TCO)

8912
THE DEVELOPMENT OF ATOMIC ENERGY IN FRANCE. V. A. (A.V.). Atomnaya Energiya 3, 171-4(1957).

The French atomic program is described in detail. The reactors which are either in the act of being built or are already completed are discussed. The efficiency of the French uranium and thorium working plants is described. With respect to atomic energy in the form of electricity it is planned that from 1975 onwards the number of electric atomic stations shall be doubled every 3 to 4 years. (TCO)

8913
FOREIGN ATOMIC TECHNOLOGY. A COLLECTION OF TRANSLATIONS, NO. 1, 1957, PUBLISHING HOUSE FOR WORKS ON ATOMIC ENERGY, 8 PRINTED SHEETS. L. I. (I. L.). Atomnaya Energiya 3, No. 10, 377(1957).

8914
THE ATOM AS AN ECONOMIC FACTOR. Wolfgang Koeck. Atomwirtschaft 3, 137-41(1958) Apr. (In German)

Utilization of atomic energy is not only, as often assumed, a branch of energy production but it branches out into communication, engineering, metallurgy, measuring and control techniques and especially into the vast supplying industry and makes various uses of radiation. The knowledge of atomic techniques will soon be the decisive factor which will govern the economic potential of every modern industrial country. Those lacking this experience will lose their export trade in boilers, turbines, pumps, measuring instruments, etc. (auth)

8915
THE BUILDING OF ATOMIC POWER PLANTS. A NEW FIELD FOR MANY INDUSTRIES. Heimo Hardung-Hardung. Atomwirtschaft 3, 143-7(1958) Apr. (In German)

Of the building cost of a nuclear power station about 40% is spent on the reactor including the fuel elements, 11% for the heat exchanger, 27% for buildings and 17% for electricity generating plant. Since a nuclear power station requires a capital investment of several hundred million Marks, some of the suppliers can expect contracts of considerable magnitude. Experience gathered during the erection of the British power stations has shown that even small firms have excellent chances to gain in this new market if they apply new ideas and imagination. This is specially true for those quite considerable parts of the plants where mainly conventional construction work is needed, but where at the same time novel demands must be met. (auth)

8916
WHERE DOES THE URANIUM PRICE STAND? E. Kruse. Atomwirtschaft 3, 169-71(1958) Apr. (In German)

The price of uranium will for some time be strongly affected by non-economical factors. The change from short to abundant world supply which is just becoming evident will, however, have its effects. Costs will have to be commercially analyzed and the price situation clarified before private enterprise can accept a greater interest in this market. A differentiation must be made between the cost for the raw material uranium ore, the manufacture of the uranium metal, and the production of the enriched nuclear fuel. (auth)

BIOLOGY AND MEDICINE

8917 NYO-4481
Atomic Bomb Casualty Commission, Hiroshima.
STUDIES ON SKELETAL DEVELOPMENT IN JAPANESE CHILDREN. ROENTGENOGRAPHIC INDICATORS OF

MATURITY IN BONES OF THE FOOT, ANKLE, KNEE AND ELBOW AREAS. Yasushi Takahashi. Dec. 15, 1956. 65p.

Observations were made on the growth and development in bones of children between the ages of seven and nineteen who were residents of the two cities of Kure and Hiroshima. Roentgenograms were taken between 1949 and 1951 on 1200 healthy children residing in these two cities. Three hundred of these roentgenograms, an average of about 10 of each sex in each age group, were selected for study. None of the children selected had been exposed to radiation from the atomic bomb. An atlas of maturity indicators for the bones of children was prepared. The appearance times of sesamoid bones were calculated for the foot and the knee. At the same chronological age, the girls were always more advanced than the males in development and maturity of the bones. The epiphysical union times determined by the author were compared with those reported in the literature. (C.H.)

8918 UCRL-5185

California. Univ., Livermore. Radiation Lab.

THE SAFETY PROGRAM OF THE UNIVERSITY OF CALIFORNIA RADIATION LABORATORY AT LIVERMORE, CALIFORNIA. Russell Gardner Herron. Apr. 14, 1958. 28p. Contract [W-7405-eng-48]. $4.80(ph OTS); $2.70 (mf OTS).

The Safety Program of the University of California Radiation Laboratory at Livermore, California, is discussed in terms of the functions of the six independent safety groups that comprise the laboratory's primary safety organization, namely, Industrial Safety, Medical Safety, Fire Prevention and First Aid, Health Chemistry, Health Physics, and High-Explosives Safety Groups. The conclusion reached is that the safety program of a large modern research laboratory is one of wide scope and complexity. It appears that the University of California Radiation Laboratory at Livermore is actively working towards the goal of maximum safety for its personnel and equipment. (auth)

8919 AEC-tr-3218

THE EFFECT OF LIGHT IN GLYCOLATE ON THE OXIDASE OF GLYCOLIC ACID IN PLANTS. THE PROBLEM OF THE SO-CALLED "ADAPTION" OF SPROUTS. P. A. Kolesnikov and S. V. Emenova. Translated from Doklady Akad. Nauk S.S.S.R. 109, 152-5(1956). 9p.

Sprouts of barley, wheat, and coriander were grown in a dark cabinet and on a window sill. A determination of the oxidase of glycolic acid was carried out in a Warburg apparatus after the leaves were ground in a mortar with a M/15-phosphate buffer, pH 7.8, with a leaf-weight to buffer ratio of 1:5. The suspension was centrifuged for five minutes at 2000 to 3000 vol/min to remove the non-active coarse parts. In the Warburg vessels, 4.5 ml of the extract and 0.5 ml of water, or 0.1M glycolic acid, preliminarily neutralized by caustic soda and 0.3 ml 20% potassium hydroxide were used. The glycolic acid was identified by paper chromatography. The extraction of the organic acid by ether was performed over a period of 5 to 6 days. Data are tabulated on the effect of light on the oxidase activity of glycolic acid from coriander sprouts; the effect of glycolate on the oxidase activity of glycolic acid in etiolated barley; the protection by glycolate for glycolic acid oxidase in etiolated leaves; and the protection by glycolate of its oxidase of green leaves. Results indicate that in the etiolated sprouts there is some kind of inactivator for the oxidase of glycolic acid which may be removed by light or neutralized by the glycolate. The glycolate apparently protects its ferment from any sort of inactivator. Apparently, for neutralization of the inactivator in the etiolated sprout, its glycolic acid is insufficient and, therefore, further addition of it is necessary. The nature of the inactivator and the protective mechanism of the glycolate are not identified. From the results of this study, the inference is drawn that the Tolbert conception of the adaptation of sprouts upon greening to the consumption of glycolic acid produced in the process of photosynthesis is not tenable. (C.H.)

8920

NUCLEAR AND ELECTRON PARAMAGNETIC RESONANCE AND ITS APPLICATION TO BIOLOGY. Power B. Sogo and Bert M. Tolbert (Univ. of California, Berkeley). Advances in Biol. and Med. Phys. 5, 1-35(1957).

Electron spin resonance and nuclear magnetic resonance both involve the absorption of electromagnetic radiation in the radio-frequency range. They may be considered as extensions of ultraviolet, visible, and infrared spectroscopy. They comprise a unique branch of spectroscopy in that one can vary the absorption energy levels at will, instead of having to use the energy levels nature has given. This advantage arises from the fact that one can vary the strength of the applied magnetic field and thus vary the spacing of the electronic and nuclear magnetic energy levels. No fundamental new truths have been demonstrated in biology by the use of nuclear magnetic resonance. Electron spin resonance measurements are beginning to give information from which one can construct a detailed picture of the nature of some biochemical reactions, such as reactions involving one-electron oxidation-reduction reactions or the so-called free radical reactions. The discovery by electron spin resonance of these free radicals in living material, and their correlation with biological activity, helps confirm what previously was only a hypothesis on certain types of enzymatic reactions. Studies to date employing electron spin resonance or nuclear magnetic resonance are reviewed. (91 references.) (C.H.)

8921

THE GENETICS OF SOMATIC MAMMALIAN CELLS. Theodore T. Puck (Univ. of Colorado Medical Center, Denver). Advances in Biol. and Med. Phys. 5, 75-101 (1957).

New quantitative techniques have been described for rapid plating of isolated single cells from a wide variety of human tissues under conditions such that almost every cell produces a macroscopic colony. These methods make possible new kinds of studies of the growth and genetics of mammalian cells. Application of these methods to problems of growth rate analysis, cell morphology, mutant production and isolation, analysis of the action of ionizing radiations, study of virus-cell interactions, and to certain problems in clinical medicine has been indicated. (21 references.) (auth)

8922

IMMUNOLOGY OF BONE MARROW TRANSPLANTATION. Takashi Makinodan (Oak Ridge National Lab., Tenn.). J. Cell. Comp. Physiol. 50, Suppl. 1, 327-51 (1957) Dec.

The role of the recognition factor of an antibody-producing cell and its relative sensitivity to x rays has a great implication, not only to radiation immunology but to general biology. Obviously, much work is still required to elucidate this problem. From an immunologist's point of view, one of the most fascinating phenomena of the bone marrow transplantation studies is the delayed foreign bone marrow reaction. The task of circumventing or subduing the reaction is a formidable one, considering the large number of immunochemically distinct antigens existing in a given bone marrow suspension. Preliminary studies seem to indicate that the nuclear membrane or the nuclear material, or both, are mainly responsible for the

delayed foreign bone marrow reaction. Should the nuclear material be found to be the chief agent involved in this delayed reaction, the problem then becomes ever more challenging since the antigenic material is chemically impure and its solubility in aqueous medium is limited. (auth)

Radiation Effects

Refer also to abstract 9397.

8923 AF-SAM-58-47
Texas. Univ., Austin.
THE EFFECT OF WHOLE-BODY RADIATION UPON ASSOCIATION OF PERIPHERAL CUES. W. Lynn Brown, Richard M. Carr, and John E. Overall. Nov. 5, 1957. 5p.

Object-quality stimuli were presented as discrimination problems to rhesus monkeys of three treatment groups: nonirradiated, low-dose irradiated, and high-dose irradiated. The experiment was designed to determine whether the subjects associated peripherally placed stimuli and whether normal and irradiated subjects differed in the extent to which such association was made. The performance of nonirradiated subjects gave evidence of association of peripherally placed stimuli; no significant evidence of such association was observed in the performance of the irradiated monkeys. The results are interpreted as supporting the hypothesis of a shift in response thresholds to extraneous stimuli and the hypothesis of a narrowing of attention in irradiated subjects. (auth)

8924 AF-SAM-58-48
Texas. Univ., Austin. Radiobiological Lab.
CONDITIONED FOOD AVOIDANCE ON A T-MAZE IN IRRADIATED RATS. Robert K. White and W. Lynn Brown. Nov. 12, 1957. 5p.

Two groups of rats, one irradiated and one sham-irradiated, were deprived of food for 21 hours preirradiation and 66 hours postirradiation before training on a T-maze. The irradiated group avoided the food arm of the maze a significantly greater number of times than the sham-irradiated group and also significantly more than by chance. This demonstrates that the avoidance motivation of irradiated rats is sufficient to motivate learning on a T-maze, that eating during irradiation is not a necessary condition for avoidance behavior at lethal levels, and that the value of food shifts from a pulse value to a minus value and not to zero. (auth)

8925 AF-SAM-58-50
Texas. Univ., Austin. Radiobiological Lab.
LATENT EFFECTS OF CHRONIC WHOLE-BODY IRRADIATION ON THE PERFORMANCE OF MONKEYS ON THE SPATIAL DELAYED-RESPONSE PROBLEM. A. A. McDowell and W. Lynn Brown. Nov. 18, 1957. 4p.

Eight normal, 13 low-dose irradiated, and 13 high-dose irradiated rhesus monkeys were tested for 24 trials a day over a 16-day period on a 10-second delayed-response problem. Previous delayed-response testing had failed to differentiate these groups during the first 100 days following the radiation exposure to which the experimental animals had been subjected two years prior to the initiation of the present experiment. The results of the present experiment demonstrated that the hypothesis of a facilitation of delayed-response performance by monkeys as a latent effect of whole-body irradiation is tenable. Normal monkeys can and do perform as efficiently at some points in time as chronic irradiated monkeys, but they appear to suffer interference from stimulus factors extraneous to solution of the problem at hand. (auth)

8926 AF-SAM-58-59
Texas. Univ., Austin. Radiobiological Lab.
IRON-59 METABOLISM AS AN INDEX OF HEMATOPOIETIC DAMAGE AND RECOVERY IN MONKEYS EXPOSED TO NUCLEAR RADIATION. Quentin L. Hartwig, George S. Melville, Jr., Thomas P. Leffingwell, and Robert J. Young. Dec. 4, 1957. 7p.

Monkeys exposed to ionizing nuclear radiations were studied for changes in iron metabolism. Twenty-eight hours after exposure, iron-59 was injected, and 24 hours later the first blood sample was drawn. Iron uptake in the irradiated animals reflected marked depression of erythropoiesis. The average uptake in all irradiates 48 hours postexposure was 2.1% as compared to 10.7% in the controls. Only 3 of the original 10 irradiates survived. Repeating the iron-59 injection technic 34 days after exposure indicated repair and active erythropoiesis in survivors. Plasma iron exhibited periods of both hyper- and hypoferremia. Those animals destined to die were consistently hypoferremic for 2 to 3 days prior to death. Postexposure implications of iron-59 incorporation levels and plasma iron values are discussed. (auth)

8927 USNRDL-TR-217
Naval Radiological Defense Lab., San Francisco.
THE EFFECT OF DOSE RATE ON GENETIC DAMAGE FROM FAST ELECTRONS IN DROSOPHILA SPERM. A. F. Yanders. Mar. 31, 1958. 17p.

Mature sperm of male Drosophila melanogaster were exposed to 3200 rads of fast electrons from a Van de Graaff accelerator, given at rates ranging from 210 rads per minute to 6400 rads per minute. The amount of genetic damage was assessed by measurements on the frequency of induction of sex-linked recessive lethal mutations and dominant Minute effects. No significant differences attributable to radiation dose rate were found between treated groups. The dose-rate effects reported by other authors using x rays are not found with fast electrons. Possible reasons for the disagreement are discussed. (auth)

8928 USNRDL-TR-226
Naval Radiological Defense Lab., San Francisco.
THE ESTIMATION OF THE NON-RECUPERABLE INJURY CAUSED BY IONIZING RADIATION. J. S. Krebs, R. W. Brauer, and H. Kalbach. Apr. 18, 1958. 21p.

Exposure of mice to a non-lethal course of x-ray treatment results in a reduction in tolerance of mice to further x-ray treatment. The reduction in tolerance to x ray amounts to a decrease of the acute LD_{50} by an average of 9.6% of the total amount of the non-lethal radiation previously given. The time of death after the LD_{50} test and the slope of the dose-response curve are not changed by the non-lethal radiation previously given, and it is inferred from this that the mechanism of acute death and the distribution of radiation sensitivity are not changed. The injury found does not account for the observed mortality of animals from chronically imposed radiation. (auth)

8929 AEC-tr-3234
THE EFFECT OF IONIZING RADIATION ON THE PROTEINS OF STRUCTURAL ELEMENTS OF THE CYTOPLASM OF THE LIVER CELLS. L. I. Ilyina, V. O. Blohina, and M. S. Uspenskaya. Translated by Lydia Venters from Med. Radiol. 2, 23-30(1957). 13p.

The yield of mitochondria and microsomes of rat's liver cells does not change in radiation sickness. The moisture content of these structures likewise remains normal. There is a change in the quantity of ribonucleoproteids and lipoproteids in mitochondria and microsomes of the liver cells in radiation sickness. The quantity of water-soluble proteins remains within the normal limits. The most

abrupt changes in ribonucleoproteids and lipoproteids in radiation sickness are found in their protein component. This is manifested in much greater changes in the nitrogen contents, as compared with phosphorus. (auth)

8930

THE COMBINED EFFECT OF HEAVY WATER AND ROENTGEN IRRADIATION ON THE ANIMAL ORGANISM. G. Häggqvist and G. Hevesy (Karolinska Institutet, Stockholm). Acta Radiol. 49, 321-5(1958) Apr.

Fish irradiated in 25% heavy water with 2,500 and 3,000 r and kept after irradiation in tap water are more damaged than when exposed to irradiation in tap water. The half-life time of fish after exposure to 2,500 r in tap water amounts to 51 days, in 25% heavy water to 37 days. The corresponding figures after 3,000 r are 22 and 15. (auth)

8931

PARTIAL-CELL IRRADIATION. Raymond E. Zirkle (Univ. of Chicago). Advances in Biol. and Med. Phys. 5, 103-46(1957).

Techniques for partial-cell irradiation and the preparation of radiation sources for use both inside and outside the cell are described. Applications of partial-cell irradiation techniques in studies of normal cell functions and as a radiobiological tool to yield information about the mechanisms by which radiations produce their effects on living systems are discussed. Results are summarized for recent studies which employed this technique. (71 references.) (C.H.)

8932

BACKGROUND RADIATION EXPOSURES OF THE GENERAL POPULATION. Simon Kinsman (Dept. of Health, Education, and Welfare, Public Health Service, Cincinnati). Am. Ind. Hyg. Assoc. J. 19, 8-14(1958) Feb.

The dose rate from naturally occurring background radiations is discussed and is used as a basis for calculations of radiation dose and as a guide for recommending permissible population exposures. Body dose is accrued by exposure to external radiation sources, such as cosmic radiation, terrestrial radioactivity, and to a lesser extent local environment which may depend on the radioactive content of the construction material of the abode, and by internal sources of radiation, such as radioactive materials taken into the body from air, food, and water. Each of these radiation sources is discussed separately and summarized collectively. (C.H.)

8933

CARCINOGENIC EFFECTS OF STRONTIUM 90 BEADS IMPLANTED IN THE LUNGS OF RATS. H. Cember and J. A. Watson (Univ. of Pittsburgh). Am. Ind. Hyg. Assoc. J. 19, 36-42(1958) Feb.

Glass beads incorporating Sr^{90} were prepared and implanted into the pulmonary parenchyma of rats. Measurements were made on the tissue dose from the beads. The radioactive beads were found to be carcinogenic, but no other difference was observed in lethal effects between rats that were treated with the radioactive beads and control rats whose chests were punctured. (C.H.)

8934

LONG TERM SEQUELAE OF MASSIVE DOSES OF I^{131} IN RATS. Patricia W. Durbin, C. Willet Asling, Muriel E. Johnston, and Joseph G. Hamilton (Univ. of California, Berkeley and San Francisco). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 101-25(1958) June.

Female rats fifty-five to sixty days of age were injected with I^{131} at dosages ranging from 10 to 90 $\mu c/g$ body weight, and during the ensuing year observations were made on impairment of health, on mortality, and on gross and microscopic pathology. Data are summarized. 64 references. (C.H.)

8935

ERYTHROCYTE SURVIVAL IN RABBITS AFTER SUBLETHAL TOTAL BODY IRRADIATION. Ronald E. Waggener, Howard B. Hunt (Univ. of Nebraska Coll. of Medicine, Omaha). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 1050-2(1958) June.

The average normal erythrocyte half survival time of 24 young adult rabbits determined by the sodium radiochromate method was fifteen days. Erythrocyte half survival time for 11 rabbits after total-body roentgen therapy of 220 r in air delivered in ten daily doses averaged 7.5 days or 47% of the normal average. Additional investigation is indicated to further establish the consistency of effect, quantitative relationship and mechanism by which irradiation reduces red blood cell survival. (auth)

8936

EFFECT OF WHOLE-BODY IRRADIATION ON THE CIRCULATION OF THE DOG. I. Leusen, G. Demeester, and P. M. Van Vaerenbergh. Arch. intern. physiol. biochim. 63, No. 4, 441-4(1955). (In French)

Dogs, weighing from 8 to 16 kg, received 400 r of whole-body irradiation. The arterial pressure and the cardiac flow were measured and the results are tabulated. No important modifications of the pressure or flow were observed either immediately after or for some days after the irradiation. However, in the terminal phase a large diminution of both these values was observed. (J.S.R.)

8937

X-IRRADIATION AND BONE MARROW. A. de Schryver, G. Demeester, and I. Leusen. Arch. intern. physiol. biochim. 65, No. 4, 599-606(1957).

At 24 hours after a 600 r whole-body irradiation, the concentration of Fe^{59}, intracardially injected immediately after the irradiation appears to be significantly increased in the bone marrow of the rat. At the same time, the radioactivity in the peripheral blood cells is depressed to 2/3 of the activity found in the control animals. From these observations and from the study of the plasma clearance of Fe^{59}, it is concluded that this increased radioactivity of the bone marrow 24 hours after irradiation, the Fe^{59} having been injected immediately after the irradiation, is caused by the decreased output of Fe^{59} tagged cells into the circulation. At 48 and 72 hours after irradiation, the uptake of Fe^{59} in the bone marrow and in the blood is equally strongly depressed. (auth)

8938

THE INCORPORATION OF Fe^{59} INTO THE HEMATOPOIETIC SYSTEM OF THE IRRADIATED RAT. A. De Schryver, G. Demeester, and I. Leusen. Arch. intern. physiol. biochim. 66, 93-5(1958). (In French)

The effect of radiation on the incorporation of iron into the hematopoietic system was determined by injecting white male rats, who had received 600 r whole-body irradiation, with Fe^{59}. The animals were killed 3, 6, 12, 20, 36, and 48 hours after the irradiation. The amounts of iron in the marrow of the tibia and femur, liver, whole blood, plasma, and red cells were measured and the results are tabulated. The results showed that after 12 hours the iron in the irradiated rat is accumulated more in the marrow, whereas in the control the iron has been released to the circulatory system. (J.S.R.)

8939

UTILIZATION OF OXYGEN BY THE SPLEEN AND SMALL INTESTINE OF THE RAT AFTER X IRRADIATION. A. de Schryver, J. de Witte, I. Leusen, and P. M. van Vaerenbergh. Arch. intern. pharmacodynamie 106, No. 1-2 178-80(1956). (In French)

Three to four hours after a total x irradiation of 750 r in the rat, a slight depression of the oxygen utilization of the

spleen developed while the absorption of oxygen by the intestinal tissues was not significantly depressed. Five days after the irradiation the respiration of the splenic tissue was sharply diminished. (tr-auth)

8940

RADIOBIOLOGICAL INVESTIGATIONS AT THE BIOLOGICAL INSTITUTE OF THE ACADEMY OF SCIENCE OF THE U.S.S.R. IN 1956. A. M. Kusin. Atomnaya Energiya 3, No. 8, 178-80(1957).

The following problems were investigated at the Biological Institute of the Academy of Science of the U.S.S.R. in 1956: what physical-chemical structural changes occur in the tissue shortly after irradiation and what is the influence exercised by radiation on the central nervous system. A total of 25 works were published by the Institute. (TCO)

8941

EFFECT OF X-RAY RADIATION ON LYMPHATIC TISSUE. Dobrila Rašković. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 133-8(1958) Mar.

The effect of x radiation on the lymphatic tissues was studied by exposing white rats, male and female, weight from 120 to 135 g, to 1500 r whole-body and local radiation. Whole-body irradiation is followed by destruction of lymphatic tissue which, after 72 hours, leads to complete involution of lymphatic organs. Lymph glands locally exposed to x radiation show the same changes as in whole body radiation until 24 hours after irradiation. Reparative and regenerative processes are accelerated. Protected lymph glands and thymus in the radiated body show more or less a normal picture with rare individual picnosis. After 48 and 72 hours mitosis was observed in many cells. Picnotic changes of thymus are of a little stronger intensity and the appearance of mitosis is slightly lower, compared with the lymph gland. The role of stress reaction after x radiation is a minimal one and is only manifest in the thymus. (auth)

8942

NEW RETICULOCYTE FACTOR OF SERUM FROM IRRADIATED NEW-BORN ANIMALS. S. Hajduković and Lj. Stošić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 139-41(1958) Mar. (In French)

A humoral factor, unknown at present, was found in the serum of new-born animals irradiated with 700 r. This factor is capable of releasing a reticulocytic crisis in non-irradiated young animals who received 0.3 cc of the serum. (tr-auth)

8943

INTERNAL IRRADIATION OF DOGS WITH RADIOACTIVE COLLOIDAL GOLD: SYNERGISTIC EFFECT OF IRON. P. F. Hahn and H. C. Meng (Meharry Medical Coll. and Vanderbilt Univ., Nashville). Cancer 11, 591-6(1958) May-June.

When irradiation of the liver was accomplished in dogs by the intravenous administration of repeated doses of relatively massive amounts of radioactive colloidal gold (Au^{198}) the effect was heightened by the previous administration of iron. This was particularly noticeable when the iron was given intravenously in particulate form, with resultant deposition in the reticuloendothelial system. Animals that were given iron in addition to Au^{198} developed ascites as well as moderately extensive cirrhotic changes in the liver. Transient but marked leukopenia was observed in the dogs that received Au^{198} alone. Erythropoiesis was not noticeably influenced, but precipitous drops in hematocrit levels that corresponded to massive internal hemorrhage were observed to occur terminally. Electrophoresis showed changes in the plasma protein constituents. There was a decided lowering of the albumin-globulin ratio as a result of lowered albumin levels. The beta globulins were considerably increased, as were the gamma globulins. Total proteins were not markedly affected. (auth)

8944

EFFECT OF γ RAYS ON THE SYNTHESIS AND β GLUCOSIDASE TRANSFER IN THE EMULSINE OF ALMONDS. Cécile Sosa-Bourdouil, Antoine Sosa, and Paul Bonet-Maury. Compt. rend. 246, 2065-7(1958) Mar. 31. (In French)

Enzymatic activity, related to the quantity of glucose combined with methanol, beginning with glucose and transfering the glucose to different β-glucosides on the methanol, is described as a function of the exposure dose following curves which occupy the same region as the β-glucosidase. The calculations corresponding to the functional dimensions of the active particle leads to values of the same order. (tr-auth)

8945

ACTION MECHANISM OF X RAYS ON TRYPSIN. MODIFICATION OF THE MICHAELIS CONSTANT. Bernard Magnan de Bornier. Compt. rend. 246, 2166-9(1958) Apr. 9. (In French)

Irradiation of a solution of trypsin by x rays causes a lessening of the affinity of the enzyme for the substrate. This lessening is shown by an augmentation of the Michaelis constant. The hypothesis is suggested that the inactivation results from an alteration of the active reaction sites on the surface of the enzyme. (tr-auth)

8946

THE EFFECTS OF X-RAYS ON THE EMBRYONAL GROWTH AND DEVELOPMENT OF HORDEUM VULGARE L. A. M. Eunus (Michigan State Coll., East Lansing). J. Exptl. Botany 6, No. 18, 409-21(1955) Oct.

The effects of x rays on the developing embryos in barley plants were manifested by a number of abnormalities such as enlargement and vacuolation of cells, disturbances in cell walls, disintegration of cells leading to the formation of cavities, disturbances in distribution of meristematic tissues, a number of proliferations in different parts of the embryo, and retarded growth of the embryo during the early post-radiation period. In addition to these, deeply stained globular cytoplasmic bodies were observed in radiated embryonic cells. Very similar kinds of abnormalities were produced by softer x rays starting from 400 r and including 800 r. The frequency of occurrence and degree of proliferations in embryos irradiated with 800 r were relatively higher than those produced by 400 r and 500 r. Treatments with 300 r units of irradiation induced only the appearance of deeply stained globular bodies within cytoplasm and no effects were visible with dosages below 300 r. Comparative measurements of cell-lengths of the treated and control embryos at undifferentiated as well as at differentiated stages showed an increase in cell-lengths within radiated embryos. Radiated embryos showed defective pattern of germination. Harder x rays were found to be less effective in inducing embryonic abnormalities than softer rays when equal calculated dosages of the two were applied to the flowering spikes of Hordeum vulgare L. (auth)

8947

GAMMA-RAY SENSITIVITY OF SPERMATOGONIA OF THE MOUSE. Eugene F. Oakberg (Oak Ridge National Lab., Tenn.). J. Exptl. Zool. 134, 343-56(1957) Mar.

Hybrid male mice were given a range of doses from 5 to 100 r of Co^{60} gamma rays, killed 72 hours after irradiation, and all spermatogonia counted in 100 tubule cross sections per mouse. Young primary spermatocytes at stages VII and VIII in the cycle of the seminiferous epithelium also were counted. Late type A, intermediate, and

early type B spermatogonia were uniformly sensitive, with an LD_{50} of approximately 20 to 24 r of Co^{60} gamma rays. Scoring of all type A spermatogonia gave survival comparable to intermediate and type B cells at 5 to 23 r, and a significantly higher survival at 30 to 100 r. The curve obtained for type A cells has been interpreted as resulting from a mixed population of cells with at least two different levels of sensitivity. These differences in sensitivity could not be correlated with specific stages in the cycle of the seminiferous epithelium, but appeared to exist even in the dormant period, where uniform radiation response might have been expected. Earlier work had shown that intermediate spermatogonia can be identified cytologically at stages II and III. On the basis of radiation data of the present investigation, this differentiation can be detected one stage earlier in the cycle of the seminiferous epithelium, namely, at late stage I to early stage II. Differentiation of intermediate spermatogonia from type A cells appears to be unaffected by radiation. (auth)

8948

FACTORS IN THE CAUSATION OF LEUKEMIA. Shields Warren (New England Deaconess Hospital, Boston, Mass.). J. Mt. Sinai Hosp., N. Y. 24, 1331-4(1957) Nov.-Dec.

Analysis of data on 183 cases of leukemia indicates that ionizing radiation is a cause of leukemia in man. The dose required appears to be on the order of several hundred r delivered either as a single large dose or multiple small doses. Exposure of a major portion of the hematopoietic or lymphopoietic tissue appears necessary. However, radiation doses approaching the lethal range fail to produce leukemia in many persons. (C.H.)

8949

THE ISOTOPE K^{40} AND ITS ROLE IN BIOLOGY. A. P. Vinogradov (Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR, Moscow). Biochemistry (U.S.S.R.) 22, 12-18(1957) Jan.-Apr.

The effect of the radioactivity of potassium-40 upon the growth and development of Aspergillus niger was studied under strict control in 9 series of experiments with different potassium content of the medium and varying isotope concentration. It was concluded that the radioactivity of naturally occurring potassium-40, and probably other radioactive substances usually contained in organisms, has no detectable influence on growth and development of the organism. (C.H.)

Radiation Hazards and Protection

Refer also to abstract 9009.

8950 HASL-25

New York Operations Office. Health and Safety Lab., AEC. EXTERNAL ENVIRONMENTAL RADIATION MEASUREMENTS IN THE UNITED STATES. L. R. Solon, W. M. Lowder, A. V. Zila, H. D. LeVine, H. Blatz, and M. Eisenbud. Mar. 11, 1958. 35p. $6.30(ph OTS); $3.00 (mf OTS).

During the Summer of 1957 ion chamber measurements were made of the external environmental radiation in locations throughout the United States. The purpose of these measurements was to establish the approximate range of population exposures to the penetrating radiation component, cosmic radiation, and terrestrial gamma radiation, but excluding terrestrial beta radiation. The natural levels encountered ranged from a low of 8.4 microroentgens/hour along the Pennsylvania Turnpike to a high of 38.6 microroentgens/hour at the summit of Pikes Peak. Among the major United States cities visited, Denver, Colorado exhibited the highest radiation levels with a range of 16.6 to 22.4 microroentgens/hour. Elevated levels associated with fall-out from nuclear weapons tests, were encountered in eastern Arkansas and the Black Hills of South Dakota. The results of this survey are compared with the estimates of other investigators; including, the measurements of Hess, Neher, Compton, and the calculations of Burch and Libby. (auth)

8951 NP-tr-73

RADIOACTIVE CONTAMINATION OF THE BIOSPHERE IN THE NETHERLANDS. CHAPTER VII. RESULT OF ACTIVITY MEASUREMENTS. J. Blok. Translated by S. Fitzgerald from p. 158-69 of thesis, published by H. A. van Bottenburg, Amsterdam. 12p.

The results of measurements of the artificial radioactivity in the air and in rainwater in the Netherlands are presented. The activities were determined over a period of two years from April 1955 to April 1957. Special attention was paid to the determination of strontium isotopes in precipitation. (J.S.R.)

8952

DECONTAMINATION OF SYNTHETIC RADIOACTIVE FALLOUT FROM THE INTACT HUMAN SKIN. William J. Friedman (U. S. Naval Radiological Defense Lab.). Am. Ind. Hyg. Assoc. J. 19, 15-19(1958) Feb.

The efficiency of nine different decontaminating agents for the removal of dry fall-out material from skin was tested using forty-five volunteer human subjects. All methods tested removed over 90% of activity, with the exception of water alone. The use of a pre-applied barrier cream did not significantly increase the decontamination efficiency of the agents studied. (C.H.)

8953

EVALUATION OF THE AIR POLLUTION PROBLEM RESULTING FROM DISCHARGE OF RADIOACTIVE EFFLUENT. Harry S. Jordan and Ralph E. Black (Los Alamos Scientific Lab., N. Mex.). Am. Ind. Hyg. Assoc. J. 19, 20-5(1958) Feb.

Soil sample analysis indicate that the emission of approximately 13 grams of plutonium over a period of 9 years does not result in contamination of the soil to the extent to cause a health hazard since the resulting soil concentrations are lower than the level of concern by approximately a factor of 10^4. The validity of the soil sample analyses was confirmed by the results of sand tray analysis, in that one month's deposition of the effluent on the sand tray correlates reasonably well with the 9-year period deposition. It is also evident that an emission rate of approximately 10^6 d/m of plutonium per minute, under conditions prevailing at Los Alamos, could not create average air concentrations in excess of permissible values. (auth)

8954

LABELING OF MANUFACTURED PRODUCTS CONTAINING RADIOACTIVE MATERIALS. W. A. McAdams (General Electric Co., Schenectady, N. Y.). Am. Ind. Hyg. Assoc. J. 19, 26-30(1958) Feb.

Radioactive materials are now being used in a variety of commercial products which are readily available to both industry and the general public. Some of these products contain quantities of radioactive materials which can be hazardous to unsuspecting customers or to those persons who handle the products in large numbers. It is necessary that each item containing a hazardous amount of radioactive material be conspicuously marked with the conventional radiation symbol. It is equally important that such marking not be used on items which do not present a radiation hazard. Various radiation protection codes and standards now in effect or under development contain special provisions for labeling such products but these

regulations are widely different. Some of the factors involved in establishing sound labeling standards are discussed and a method for deriving suitable limits is proposed. (auth)

8955

CLINICAL EXPERIENCES WITH RADIOACTIVE MATERIALS. Harry Foreman, William Moss, and Bernard C. Eustler (Los Alamos Scientific Lab., N. Mex.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 1071-9 (1958) June.

Case reports are presented on 1 individual who received an internal dose of Am^{241}, on 2 individuals who accumulated Pu^{239} internally, and on 2 individuals who received a body burden of Po^{210}. The urinary excretion of the isotopes was followed closely over a long period of time in all cases, and the results of the assays are reported. In 2 cases, the assays on feces are also presented. The results of attempts to accelerate excretion of the isotopes are presented. A procedure for evaluating the initial dose, the body burden at given periods of time, and the effect of treatment is given. The technique for estimating the dose received from the polonium exposure is described and the dose received evaluated. (auth)

8956

SOME FACTORS TO BE CONSIDERED IN A PROTECTION PROGRAM FOR USE OF RADIATION SOURCES. H. W. Speicher (Westinghouse Electric Corp., Pittsburgh). Arch. Ind. Health 17, 546-55(1958) May.

Radiation sources should be selected with respect to health hazards that need to be controlled as well as the properties of the various emitters. Factors to be considered in radiation protection are discussed. (C.H.)

8957

PERSONNEL PROTECTION DURING REPAIR WORK IN CONTAMINATED AREAS. S. M. Gorodinsky and V. L. Shcherpakov. Atomnaya Energiya 3, No. 8, 141-8(1957).

If repairs have to be carried out in radioactively contaminated areas, it is necessary to protect the personnel against γ radiation (by short working hours) and against their skin coming into contact with radioactive isotopes. This is done by protective clothing and face masks. The Russian protective suits LG-1 and LG-2 and the face masks ShB-1 and ShB-2 are described briefly. (TCO)

8958

ON THE CONSTRUCTION OF SOME TOOLS AND MANIPULATORS WHICH ARE USED WHEN WORKING WITH RADIOACTIVE SUBSTANCES. N. V. Samokhvalov. Atomnaya Energiya 3, No. 10, 368-70(1957).

The following devices are described: spacing pincers for handling chemical implements at a distance of about 50 cm from the body; micropumps and micropipettes; radiomanipulation table with protective screen for remote-control manipulations; and heavy containers for storing and transportation of strong radioactive preparations. A special device has been developed for storing, transport, and easy manipulation of radioactive preparations for medical purposes. Also, information is included on the construction of some tools and manipulators and on the special precautions necessary in transportation of the containers. (R.V.J.)

8959

PHYSICOCHEMICAL PROPERTIES OF CIRCULATING RED BLOOD CELLS OF LETHALLY X-IRRADIATED MICE TREATED WITH RAT BONE MARROW. Takashi Makinodan and Norman G. Anderson (Oak Ridge National Lab., Tenn.). Blood 12, 984-92(1957) Nov.

Two months after injection of rat bone marrow into lethally x-irradiated mice (950 r-RBM mice), 100% of the circulating RBC were serologically of the rat type, indicating that the surface molecular configuration of RBC from these experimental mice are of the rat type. The hemoglobin was found to be also very much like the rat type in its ease in crystallization, its alkali denaturation property, its electrophoretic property, and its tendency to form a paracrystalline state at low temperature. These cells possessed dual osmotic properties; the relative hemoglobin concentration released when cells were lysed in water was more comparable to the rat type, but its temperature dependency was more comparable to the mouse type. (auth)

8960

AN EXAMINATION OF THE CLINICAL AND EXPERIMENTAL DATA RELATING TO THE POSSIBLE HAZARD TO THE INDIVIDUAL OF SMALL DOSES OF RADIATION. L. F. Lamerton (Royal Cancer Hospital, London). Brit. J. Radiol. 31, 229-39(1958) May.

An immediate reduction in the amount of radiation received by patients during diagnostic radiography may be achieved by the universal application of relatively simple procedures, by ensuring adequate tube filtration, by the use of small cones, by minimizing screening time, and by the use of gonad shields. New developments in engineering and physics will allow smaller and smaller doses of radiation to be used. Physiological and pathological studies of the mechanisms of production of the late effects of radiation will lead to new insight into radiation dangers from diagnostic applications of radiation. (C.H.)

8961

RECOVERY FROM RADIATION INJURY IN RATS FOLLOWING ADMINISTRATION OF RAT ISOLOGOUS HIGHLY POLYMERIZED NUCLEIC ACIDS. Bosiljka Panjevac and Gordana Ristić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 159-60(1958) Mar.

Some preliminary data are presented on the recovery of rats treated with nucleic acids and bone-marrow suspensions. All the rats received a whole-body exposure of 200 kvp at approximately 16 weeks of age. Following irradiation the rats were injected with highly polymerized desoxyribonucleic acid (DNA), ribonucleic acid (RNA), or rat bone-marrow suspension. Approximately 30% of the rats treated with RNA were alive after 30 days, whereas all of the control rats were dead after 14 days. The bone-marrow suspensions and DNA seem to be less effective in affording protection against radiation death. (J.S.R.)

8962

FATE OF INJECTED RAT BONE MARROW CELLS IN IRRADIATED MICE. Takashi Makinodan (Oak Ridge National Lab., Tenn.). J. Cell. Comp. Physiol. 50, Suppl. 1, 157-61(1957) Dec.

The circulating platelets, red blood cells, and granulocytes of lethally irradiated mice treated with rat bone marrow were analyzed at various intervals. On the basis of the observations, it was concluded that transplantation and proliferation of granulocyte, platelet, and erythrocyte precursors take place when bone marrow cells are injected into lethally irradiated recipients. (C.H.)

8963

ABSORPTION AND TRANSLOCATION OF STRONTIUM AND CAESIUM BY PLANTS FROM FOLIAR SPRAYS. L. J. Middleton (Agricultural Research Council Radiobiological Lab., Grove, Berks and Agricultural Research Council Field Station, Compton, Berks, Eng.). Nature 181, 1300-3(1958) May 10.

The absorption of fission products by the leaves of plants is studied. A representative range of agricultural and horticultural crops (wheat, potato, french bean, swede, sugar beet, and cabbage) were grown in pots or boxes. Replicated batches of plants were sprayed with strontium-

89 or cesium-137 at different stages of growth. When mature, the plants were harvested, divided into their various parts, and the concentration of strontium-89 and cesium-137 was determined. Roots other than those of the sugar beet and swede were not harvested. (W.D.M.)

8964

REACTIVITY OF SULFHYDRYL AND DISULFIDE GROUPS IN SERUM OF MAN. Aubin Heyndrickx (Univ. of Ghent, Belgium and Argonne National Lab., Lemont, Ill.). Proc. Soc. Exptl. Biol. Med. 96, 508-12(1957).

Reactivity of sulfhydryl and disulfide groups in normal and cancerous sera was studied under the influence of UV radiation, detergents, and electrolysis. We were able to demonstrate that serum as such contains reactive –S–S– groups, and that the reactivity of –SH and –S–S– differs according to age and for normal and cancerous serum. The greater amount of –SH and –S–S– found after irradiation could be due to unfolding of the spiral structure of the protein and consequent release of the residual bonds. The energy required for normal serum is greater in the case of younger people (up to 25 years) than for older people (aging effect) and also greater for normal serum than for cancerous ones. Sodium laurylsulfate also greatly increased the –SH and –S–S– content, which can be explained by the unfolding property of the molecule. The electrolysis of serum in acid medium made it possible to reduce –S–S– groups in proteins; the response of serum to this treatment is described. The possible relation of these results to the protective action of –SH against irradiation is discussed. (auth)

8965

DECONTAMINATION AND POTABILITY OF THE WATERS OF THE RIO DE LA PLATA AFTER A NUCLEAR EXPLOSION. Leopoldo Jose Anghileri. Publs. com. nacl. energia atomica (Buenos Aires) Ser. quim. 1, No. 12, 141-88(1957). (In Spanish)

Decontamination values were determined (decontamination factor and percentage decontamination) for different isotopes, using the potabilization process of Obras Sanitarias de la Nación with Rio de la Plata water. The decontamination efficiencies of the different processes in the case of contamination by fission products and by activation of the water were then compared. By means of a small pilot plant, a process applicable to Obras Sanitarias de la Nación in the event a contamination caused by nuclear fission occurs was tested. (auth)

Radiography

8966

ON THE CONSTRUCTION OF IRRADIATION GUNS AND DEVICES FOR RADIOBIOLOGICAL INVESTIGATIONS. L. L. Vannikov and N. V. Samokhvalov. Atomnaya Energiya 3, No. 10, 370-2(1957).

A description is given of the construction of four radiation sources. (J.S.R.)

Radiotherapy

8967 ORINS-21

Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.

RADIOACTIVE ISOTOPES IN THE UNITED STATES HOSPITALS. A Survey of Hospital Administrators' Problems up to 1957. Marshall Brucer, J. H. Harmon, and William D. Gude. 49p. Contract AT-40-1-GEN-33. $1.50(OTS).

Results are presented from a survey of the use of radioactive isotopes in hospitals in the United States in 1957. Administrative problems encountered in a radioisotope program are discussed. (C.H.)

8968

A STUDY OF DOSE LEVELS IN RADIO-IRIDIUM GAMMA-RAY THERAPY. J. S. Mitchell and J. L. Haybittle (Addenbrooke's Hospital, Cambridge, Eng.). Acta Radiol. 49, 233-45(1958) Mar.

The results of treatment of 130 cases of squamous carcinoma of the skin, 44 cases of carcinoma of the larynx, and 104 cases of carcinoma of the pharynx have been studied with a view to assessing the dose levels to be used with radio-iridium, Ir^{192}, γ-ray therapy. No significant differences have been found between the results obtained by treatment with either radio-iridium γ-rays or 220 kv roentgen-rays, or, in the cases of carcinoma of the skin only, with radium γ-rays. (auth)

8969

STUDIES DIRECTED TOWARD THE USE OF ANTIBODIES AS CARRIERS OF RADIOACTIVITY FOR THERAPY. William F. Bale and Irving L. Spar (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Advances in Biol. and Med. Phys. 5, 285-356(1957).

The relationship of immunological reactions to the growth of normal and abnormal tissues are reviewed. The highly selective localization of a radioactivity-carrying antibody in a particular normal or neoplastic tissue depends on the existence of an antigenic substance accessible to intravenously administered antibody. Procedures likely to be involved in using antibodies for the tissue-specific localization of radioisotopes in therapeutic dosage ranges are discussed. (156 references.) (C.H.)

8970

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Toxicology Studies

8979 AECU-3574

Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.

A STUDY OF THE TISSUE RESPONSE TO STERILE DEPOSITS OF PARTICULATE MATERIAL. Thomas L. Chiffelle, Faith Sherping, Vernon C. Goldizen, and Clayton S. White. Oct. 1957. 107p. Contract AT(29-1)-1242. $2.75(OTS).

Thirty-seven sterile materials of common construction usage, common lubricants, and samples of wearing apparel were injected as finely divided particles into the subcutaneous soft tissues of guinea pigs, each in six different sites. At intervals of 3, 7, 14, 21, 30, 60, or 90 days, an inoculation site of each material was excised, in toto, fixed, and examined microscopically. In addition, ten selected materials were injected into the liver and spleen and deposited on the omentum and mesentery of four guinea pigs for each material type. At intervals of 7, 14, 21, and 30 days, one of each group of four animals was sacrificed and a block of tissue containing the inoculum was removed from the tissues and organs, fixed, and examined histologically. The majority of materials induced only a mild and delayed inflammatory response followed by encapsulation at the end of 14 days and a relatively inert fibrous nodule produced by the 21st or 30th day. Copper particles incited a marked inflammatory response with abscess formation which persisted until the 90th day, although showing signs of subsiding at this time. Cadmium lesions were characterized by a peculiar zone of necrosis about the particle aggregate which persisted until the 60th day. Duraluminum of one type incited a pseudoneoplastic fibrous response. Axle grease, in the early stages, induced one of the most intense acute inflammations, in contrast to that produced by motor oil and ordinary lubricating grease, but the process had subsided and was fibrosed by the end of 30 days. (auth)

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The boron hydrides, and some of the related compounds used in high-energy fuels, are toxic and their safe use depends upon proper knowledge and safety practices. No permanent damage was observed in employees handling these materials over a ten-year period. (C.H.)

89 or cesium-137 at different stages of growth. When mature, the plants were harvested, divided into their various parts, and the concentration of strontium-89 and cesium-137 was determined. Roots other than those of the sugar beet and swede were not harvested. (W.D.M.)

8964

REACTIVITY OF SULFHYDRYL AND DISULFIDE GROUPS IN SERUM OF MAN. Aubin Heyndrickx (Univ. of Ghent, Belgium and Argonne National Lab., Lemont, Ill.). Proc. Soc. Exptl. Biol. Med. 96, 508-12(1957).

Reactivity of sulfhydryl and disulfide groups in normal and cancerous sera was studied under the influence of UV radiation, detergents, and electrolysis. We were able to demonstrate that serum as such contains reactive –S–S– groups, and that the reactivity of –SH and –S–S– differs according to age and for normal and cancerous serum. The greater amount of –SH and –S–S– found after irradiation could be due to unfolding of the spiral structure of the protein and consequent release of the residual bonds. The energy required for normal serum is greater in the case of younger people (up to 25 years) than for older people (aging effect) and also greater for normal serum than for cancerous ones. Sodium laurylsulfate also greatly increased the –SH and –S–S– content, which can be explained by the unfolding property of the molecule. The electrolysis of serum in acid medium made it possible to reduce –S–S– groups in proteins; the response of serum to this treatment is described. The possible relation of these results to the protective action of –SH against irradiation is discussed. (auth)

8965

DECONTAMINATION AND POTABILITY OF THE WATERS OF THE RIO DE LA PLATA AFTER A NUCLEAR EXPLOSION. Leopoldo Jose Anghileri. Publs. com. nacl. energia atomica (Buenos Aires) Ser. quim. 1, No. 12, 141-88(1957). (In Spanish)

Decontamination values were determined (decontamination factor and percentage decontamination) for different isotopes, using the potabilization process of Obras Sanitarias de la Nación with Rio de la Plata water. The decontamination efficiencies of the different processes in the case of contamination by fission products and by activation of the water were then compared. By means of a small pilot plant, a process applicable to Obras Sanitarias de la Nación in the event a contamination caused by nuclear fission occurs was tested. (auth)

Radiography

8966

ON THE CONSTRUCTION OF IRRADIATION GUNS AND DEVICES FOR RADIOBIOLOGICAL INVESTIGATIONS. L. L. Vannikov and N. V. Samokhvalov. Atomnaya Energiya 3, No. 10, 370-2(1957).

A description is given of the construction of four radiation sources. (J.S.R.)

Radiotherapy

8967 ORINS-21

Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.

RADIOACTIVE ISOTOPES IN THE UNITED STATES HOSPITALS. A Survey of Hospital Administrators' Problems up to 1957. Marshall Brucer, J. H. Harmon, and William D. Gude. 49p. Contract AT-40-1-GEN-33. $1.50(OTS).

Results are presented from a survey of the use of radioactive isotopes in hospitals in the United States in 1957. Administrative problems encountered in a radioisotope program are discussed. (C.H.)

8968

A STUDY OF DOSE LEVELS IN RADIO-IRIDIUM GAMMA-RAY THERAPY. J. S. Mitchell and J. L. Haybittle (Addenbrooke's Hospital, Cambridge, Eng.). Acta Radiol. 49, 233-45(1958) Mar.

The results of treatment of 130 cases of squamous carcinoma of the skin, 44 cases of carcinoma of the larynx, and 104 cases of carcinoma of the pharynx have been studied with a view to assessing the dose levels to be used with radio-iridium, Ir^{192}, γ-ray therapy. No significant differences have been found between the results obtained by treatment with either radio-iridium γ-rays or 220 kv roentgen-rays, or, in the cases of carcinoma of the skin only, with radium γ-rays. (auth)

8969

STUDIES DIRECTED TOWARD THE USE OF ANTIBODIES AS CARRIERS OF RADIOACTIVITY FOR THERAPY. William F. Bale and Irving L. Spar (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Advances in Biol. and Med. Phys. 5, 285-356(1957).

The relationship of immunological reactions to the growth of normal and abnormal tissues are reviewed. The highly selective localization of a radioactivity-carrying antibody in a particular normal or neoplastic tissue depends on the existence of an antigenic substance accessible to intravenously administered antibody. Procedures likely to be involved in using antibodies for the tissue-specific localization of radioisotopes in therapeutic dosage ranges are discussed. (156 references.) (C.H.)

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Tracer Applications

Refer also to abstract 9311.

8981

STUDIES ON EXOGENOUS CHOLESTEROL METABOLISM IN HUMAN ATHEROSCLEROSIS WITH THE AID OF ISOTOPES. Max W. Biggs (Univ. of California, Livermore). Advances in Biol. and Med. Phys. 5, 357-84(1957).

Present concepts on the role of lipid and lipoprotein metabolism in atherosclerosis are reviewed. Results are summarized from experiments on the fundamentals of cholesterol metabolism performed in humans with tritium-labeled cholesterol. (53 references.) (C.H.)

8982

THE DEVELOPMENT AND APPLICATIONS OF LOW LEVEL COUNTING. E. C. Anderson (Los Alamos Scientific Lab., N. Mex.) and W. F. Libby (U. S. Atomic Energy Commission, Washington). Advances in Biol. and Med. Phys. 5, 385-423(1957).

This paper presents some selected examples of low level counting problems which have been successfully solved. The production and distribution of natural radiocarbon and tritium are sketched as a background for a discussion of the measurements of these interesting nuclides. Applications of the results to various problems in archaeology, geology, and geochemistry are given. Some general principles of low level counting techniques are then presented, and the specific techniques developed for C^{14} and H^3 are described. The application of low level counting principles to the determination of fission product contamination of people and foodstuffs is illustrated by the Sr^{90} and Cs^{137} studies. An attempt is made to mention a few applications of the techniques to more conventional branches of biological and medical physics. (126 references.) (C.H.)

8983

THE FATE OF I^{131} TAGGED ROSE BENGAL IN THE RAT. Antone G. Jacobson and Robert L. Brent (Walter Reed Army Inst. of Research, Washington). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 1004-9(1958) June.

Applications of rose bengal tagged with iodine-131 for liver function tests, in the localization of liver abnormalities, and as a test of bile duct potency are reviewed. Data are presented from a study on the tissue distribution of I^{131}-tagged rose bengal in rats following intravenous and direct-stomach administration. (C.H.)

8984

METABOLISM OF RADIO-RUTHENIUM IN THE RAT. CONSIDERATION OF PERMISSIBLE EXPOSURE LIMITS. Roy C. Thompson, Maurice H. Weeks, O. LeRoy Hollis, John E. Ballou, and Willa D. Oakley (General Electric Co., Richland, Wash.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 1026-44(1958) June.

The metabolism of ruthenium in the rat was studied in experiments involving the acute and chronic administration of Ru^{106} by various routes. Gastrointestinal absorption amounts to about 3 per cent of ruthenium fed as solutions in the pH range from 1 to 4, and is little affected by the chemical state or previous history of the solutions or by the concentration of ruthenium. The highest concentration of ruthenium, even after prolonged chronic feeding, is present in the kidney. Bone and gonads also accumulate sufficient concentrations of ruthenium to make them of comparable hazard concern to the kidney. Because of uncertainties inherent in the extrapolation of the rat data to man, an unequivocal choice of critical organ among these three possibilities cannot be made. Based on a permissible dose to the critical organ of 0.3 rem/week, the maximum permissible concentration for Ru^{106} in water is calculated to be 4×10^{-3} μc/ml. This would be approximately correct on the assumption of either kidney, bone, or gonads as critical organ. Limiting irradiation of the gastrointestinal tract itself to 0.3 rem/week results in a lower maximum permissible concentration of 1×10^{-4} μc/ml. Applying a genetic limit of 10 r to the gonads during the first thirty years of life results in a maximum permissible concentration of 5×10^{-5} μc/ml. (auth)

8985

STUDY OF WATER METABOLISM IN CIRRHOTIC PATIENTS WITH TRITIATED WATER. A. Aeberhardt, P. Fallot, J. Canivet, and J. Masson (Service de Biologie du Commissariat a l'Energie Atomique, Saclay, France). Intern. J. Appl. Radiation Isotopes 2, 62-75(1957). (In French)

The specific radioactivity of the blood and of the ascitic fluid has been studied, versus time, after the administration of tritiated water to eighteen cirrhotic patients with ascitis. The modes of administration were oral, intravenal, and peritoneal, either singly or successively for certain patients. The disturbances of the water metabolism, due to the presence of ascistis and of the other pathological fluids, show themselves by the existence of a "slow exponential term" (isolated by graphical analysis of the experimental curves), by the increase, in 30% of the cases, of the fraction of the body weight represented by the total water, and by a prolongation of the "the biological half-life" of the water. The turnover rate of the ascitis is between 40 and 120% an hour, according to the patient. This turnover rate, which can be fixed only in very accurate conditions, seems to be correlated to the prognosis. The experimental results obtained in the course of the double experiments (oral and intravenous) show the role of the circulatory troubles in the portal system, in the exchanges of the tracer between the blood and the ascitic fluid. (tr-auth)

8986

THE INHIBITION OF THE UPTAKE OF RADIOPHOSPHATE IN NORMAL AND SICKLE ANEMIC RED BLOOD CELLS. G. P. Labat and H. Branson (Howard Univ., Washington). Intern. J. Appl. Radiation and Isotopes 3, 100-3(1958).

Through the use of P^{32} a coefficient of transfer and a coefficient of inhibition of transfer are defined precisely for the transport of phosphate into the human red blood cell. The method is applied to a study of the inhibitory effect of sodium fluoride on the uptake of radiophosphate by sickle cell red blood cells. The data reveal that there may be an intrinsic quality in the sickle cell which is different in the normal cell since the rate of transfer of phosphate in the sickle cell is the same with or without sodium fluoride while transport in the normal red blood cell is strongly inhibited by fluoride. (auth)

8987

THE PATH OF CARBON IN PHOTOSYNTHESIS. XXII. THE IDENTIFICATION OF CARBOXYKETOPENTITOL DIPHOSPHATES AS PRODUCTS OF PHOTOSYNTHESIS. V. Moses and M. Calvin (Univ. of California, Berkeley). Proc. Nat. Acad. Sci. U. S. 44, 260-77(1958) Mar.

Two new compounds, tentatively identified, have been isolated from chromatograms of ethanol-water extracts of cells of Chlorella pyrenoidosa which had been allowed to carry on photosynthesis for 3 minutes in the presence of $NaHC^{14}O_3$. Chemical investigation suggested that the two compounds were 1,5 diphosphate esters of 2-carboxy-4-ketopentitol and of the lactone of 2-carboxy-3-ketopentitol. The latter has been postulated as an intermediate in the photosynthetic carboxylation of ribulose-1,5-diphosphate to yield two molecules of 3-phosphoglyceric acid. While

the former might be an artifact resulting from the techniques used to kill, extract, and analyze the cells, possible biological roles for it have been suggested. (auth)

CHEMISTRY

Refer also to abstract 9184.

8988 NP-6669

Iowa State Coll., Ames.

ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH TEMPERATURE LUBRICANTS AND RELATED MATERIALS. Progress Report for December 15, 1957 to March 31, 1958. Henry Gilman, Bernard J. Gaj, and Mark B. Hughes. 37p. Contract AF33(616)-3510.

In extension of earlier studies concerned with organic compounds containing one or more hydrogen atoms attached to silicon, it was shown that the reaction of an alkyl SiH_3 compound with an alkyl MgX compound in tetrahydrofuran yields an alkyl$_2$$SiH_2$ type. This in turn with an RMgX type like allylmagnesium chloride gives (in tetrahydrofuran) the R_3SiH compound. From this, by means of an RLi compound, one can obtain the R_4Si type. Previously it appeared that the formation of completely unsymmetrical R_4Si types was more restricted to $Si-H_3$ and SiH_2 compounds having aryl groups attached to the silicon. Incidental to the synthesis of a wide variety of organic compounds containing the SiH_3 or SiH_2 or SiH groupings, some correlations between such structures and infrared spectra have been developed. Also, some novel high-temperature reactions of the silicon-hydrogen types are presented. A significant extension to the preparation of "custom-made" molecules is the normal reaction of some R_3SiM types with compounds like aliphatic ketones and aldehydes. These hydroxy- containing compounds are relatively resistant to rearrangement to the Si-O-R structures. It was observed that some compounds containing the silicon-nitrogen structure have greater hydrolytic stability than might have been predicted. A wide variety of Si-N types is being prepared to establish, among other things, the scope and limitations of their thermal and their hydrolytic stabilities. Two interesting reactions might be mentioned in connection with some organosilicon compounds containing nitrogen. One of these is a product of reaction of acridine with R_3SiM types to give a so-called built-in anti-oxidant. Another is the attachment of the 2-pyridyl and of the 4-pyridyl group to silicon. The 4-(triphenylsilyl)pyridine has a promising thermal stability. Incidental to the preparation of new organosilicon types, appropriate solvents for effecting cleavage reactions with various metals were examined. At this stage it appears that one of the more satisfactory solvents is tetrahydropyran. The cleavage of phenylated Group V-B elements should provide a means of preparing not only Si-N types, but also related compounds. (For preceding period see NP-6331.) (auth)

8989 AEC-tr-3209

STUDY OF SEVERAL COMPLEX COMPOUNDS OF CADMIUM AND ZINC WITH THE AID OF ION EXCHANGE. I. A. Korshunov, A. P. Pochinailo, and V. M. Tihomirov. Translated by Lydia Venters from Zhur. Neorg. Khim. 2, 68-72(1957). 11p.

Chemical composition and instability constants of several complex compounds of zinc and cadmium ions with oxalate and tartrate ions and also zinc ions with thiosulfate and citrate ions were determined by ion exchange and radiochemical methods. From the experimental conditions it has been determined, that the instability constant of the complex $[Cd\ (C_2O_4)_2]^{2-} = 2.26 \times 10^{-6}$, of the complex $[Cd\ (C_4H_4O_6)_2]^{2-} = 3$ to 25×10^{-5}, of the complex $[Zn\ (C_2O_4)_2]^{2-} = 7.7 \times 10^{-8}$, of the complex $[Zn\ (C_4H_4O_6)_2]^{2-} = 2.3 \times 10^{-6}$, of the complex $[Zn\ (S_2O_3)_2]^{2-} = 2.6 \times 10^{-5}$, and of the complex $[Zn\ (C_6H_5O_7)]^{-} = 2.8 \times 10^{-4}$. (auth)

8990 AEC-tr-3212

STUDY OF THE COMPLEX COBALT OXALATES BY MEANS OF ANION EXCHANGE. THE THEORETICAL BASIS OF THE METHOD. V. V. Fomin and V. V. Sinkovskii (Sinkovsky). Translated by Lydia Venters from Zhur. Neorg. Khim. 1, 2316-26(1956). 19p.

A method for determination of the stability constant of the complex ions in solution by means of anion exchange was worked out. The method has been used for the determination of the stability constant of the complex cobalt oxalates. It has been found that cobalt ions Co^{2+}, $CoC_2O_4^0$, $Co(C_2O_4)_2^{2-}$, and $Co(C_2O_4)_3^{4-}$ exist in the solution at the ammonium oxalate concentration from 1×10^{-4} to 3×10^{-1} mole/l which indicates amounts of cobalt. By experiment relationships between the stability constants (expressed in concentrations) to the second and third ion forms of the stability constant relative to the first one have been found; they equal relatively $K_1 = 1.5 \times 10^2$ and $K_2 = 4.5 \times 10^3$. Using the previously determined stability constants of the first complex $[Co(C_2O_4)]$, the stability constants of all the ions have been calculated, which equal accordingly $\beta_1 = 3.1 \times 10^4$, $\beta_2 = 4.6 \times 10^6$, and $\beta_3 = 1.35 \times 10^8$. (auth)

8991 AEC-tr-3213

A STUDY OF THE HYDROGEN EXCHANGE REACTION WITH THE AID OF LIQUID HYDROGEN FLUORIDE. Ya. M. Varshavskii, M. G. Lozhkin, and A. I. Shatenshtein. Translated by Lydia Venters from Zhur. Fiz. Khim. 31, 1377-86(1957). 16p.

Qualitative determinations of the solubility of 40 organic substances in liquid HF and observations about the effect of BF_3 on the solubility and on the color of the solutions were made. The distribution factor of deuterium between aromatic C-H bonds and HF was determined. It equals 1.16 at 20°C. The rate of the hydrogen exchange between liquid DF and aromatic hydrocarbons (benzene, naphthalene, phenanthrene, anthracene, toluene) was determined, and the hydrogen exchange in several saturated hydrocarbons (methylcyclopentane, methylcyclohexane, decalin, and others) was studied. The catalytic action of BF_3 on the isotopic hydrogen exchange reactions was demonstrated. Increase of the dielectric constant and polarity of the molecules of the solvent increase the rate of the isotopic hydrogen exchange, but reversal of the substance into positively charged ions makes more difficult the hydrogen exchange with the acid. Presence of a tertiary carbon atom and oxidation of methyl hydrogen in the molecule of saturated hydrocarbons are not necessary conditions for a normal course of the isotopic hydrogen exchange. (auth)

8992 AEC-tr-3224

PRODUCTION OF $AlCl_3$ FROM ALUMINA OR OTHER ALUMINUM COMPOUNDS. Translated by K. S. Bevis from p. 166-70 of Gmelins Handbuch der Anorganischen Chemie System No. 35, B 1-2, Berlin, 1934. 7p.

Methods for the production of $AlCl_3$ by chlorination of aluminum oxide, aluminum sulfate, aluminum sulfide, aluminum nitride, and aluminum silicates are briefly outlined. (J.E.D.)

8993 AEC-tr-3241

THEORETICAL PROBLEMS ASSOCIATED WITH THE DETERMINATION OF THE COEFFICIENTS OF AUTO-DIFFUSION IN SOLIDS BY THE METHOD OF HETEROGENEOUS ISOTOPIC EXCHANGES. Gaston Berthier. Translated from J. chim. phys. 49, 527-36(1952). 21p.

Use of the method of heterogeneous isotopic exchanges for the determination of the coefficients of autodiffusion in solids requires explicit knowledge of the equations that represent the kinetics of the phenomenon utilized. These equations are given in the form of numerical tables that permit a convenient evaluation of the coefficients of autodiffusion. (auth)

8994 AEC-tr-3242

A MASS SPECTROMETRIC METHOD FOR DETERMINING THE DIFFUSION CONSTANTS OF GASES IN SOLIDS. W. Gentner and E. A. Trendelenburg. Translated from Z. Naturforsch. 9a, 802-4(1954). 5p.

In determining the age of minerals by the helium or argon method, it is necessary to take into consideration the losses of the radiogenic rare gases due to diffusion. Estimations of the diffusion constants of helium and argon in the temperature range 40 to 80°C were made by means of systematic investigations in sylvites of the relations between the mean crystal size and the age measured. In the experiments reported diffusion constants of this type were measured in a laboratory experiment at higher temperatures, using the appropriate temperature low. These diffusion constants are then compared by extrapolation with the values obtained from age determinations. (W.L.H.)

8995 AEC-tr-3243

DETERMINATION OF THE COEFFICIENTS OF AUTO-DIFFUSION BY THE METHOD OF HETEROGENEOUS ISOTOPIC INTERCHANGES. PART II. THE CASE OF A RESISTANCE TO THE TRANSFER OF MATTER ON THE SURFACE OF SEPARATION OF THE PHASES. Gaston Berthier. Translated from J. chim. phys. 52, 41-7(1955). 16p.

Equations of diffusion relative to heterogeneous isotopic exchange experiments have been resolved under the hypothesis of a resistance offered to the transfer of matter by the surface of separation of the phases present. The solutions obtained constitute a generalization of the equations previously used and furnish a more complete representation of experimental results. The case where the resistance to the transfer of matter is the phenomenon that determines in a decisive way the kinetics of the reaction is examined in detail. (auth)

8996 AEC-tr-3244

THE ISOTOPE FREQUENCY OF BORON. MASS SPECTROMETRIC INVESTIGATION OF THE ELECTRON IMPACT PRODUCTS OF BF_3 AND BCl_3. O. Osberghaus. Translated from Z. Physik 128, 366-7(1950). 17p.

To measure the isotope frequency of boron, a mass spectrometer is used with 60° deflection, in which case the currents of ions can be recorded by a Braun tube, in addition to the galvanometer. The mixing ratio B^{11}/B^{10} is established as 4.11 ± 0.02. Deviations of the isotopic composition of six different boron minerals that are compared with each other, still lie within the error for measurement (0.5%). The input potentials (appearance potentials) of the ions originating from BF_3 and BCl_3 are measured and discussed in their connection with thermochemical data. Ionization functions of the ions produced from BF_3 and BCl_3 by electron impact show marked differences. (auth)

8997 NP-tr-69

COMPLEX ACID-NITROSO COMPOUNDS OF RUTHENIUM. O. E. Zvyagintsev and S. M. Starostin. Translated by J. B. Sykes from Zhur. Neorg. Khim. 2, 1281-8(1957). 14p.

Complex acid-nitroso compounds of ruthenium were investigated, and an attempt was made to discover the reasons for their stability. Several new compounds of ruthenium were obtained: $RuNO(NO_3)_2 \cdot 2H_2O$, $RuNO(NO_3)_2 \cdot 3H_2O$, $RuNO(CH_3COO)_2$, $Na[RuNO(CH_3COO)_3] \cdot H_2O$, $H_2[RuNO(C_2O_4)_2]$, $H_2[RuNO(C_2O_4)] \cdot H_2O$, $(NH_4)_2[RuNO(C_2O_4)_2]$, $Mg[RuNO(C_2O_4)_2]$, and $H[Ru(C_2O_4)_2] \cdot 2.5H_2O$. The valency of ruthenium in all the nitroso compounds obtained must be even since they are diamagnetic. It is almost certainly 2 from their composition and monomerism. These arguments are insufficient, however, for a final decision on the valency as there exist diamagnetic compounds of tervalent ruthenium. The coördination numbers in some of the compounds were unusual, such as 3 and 5. The NO group is not an ordinary addend. No case was observed in which more than one NO group was added. In this respect the nitroso compounds of ruthenium resemble those of platinum. A second property of this addend is that it is very firmly bound to the ruthenium, and is not broken off by exchange reactions in the internal sphere of the complex compound. This addend easily enters the internal sphere of complex ruthenium compounds when gaseous NO acts on them. Finally, the presence of the NO group stabilizes all the complex compounds which it enters. The nitroso compounds of ruthenium are chemically very stable and the ruthenium does not give the characteristic reactions. The great stability of the ruthenium nitroso compounds, which are very likely to be formed in the treatment of nuclear fuels, may explain the difficulty of removing radio-ruthenium. (auth)

8998 NP-tr-79

USE OF ION EXCHANGE TO STUDY THE STATE OF MATTER IN SOLUTION. V. I. Paramonova. Translated by P. Collins from Zhur. Neorg. Khim. 2, 523-31(1957). 19p.

The principle of the proposed method of study of the state of matter in solution is as follows: one and the same solution is brought to equilibrium both with a cation exchange material and with an anion exchange material; then the quantity of the investigated element absorbed by the materials is determined. From these data qualitative and some quantitative conclusions may be made about the state of the matter in the solution. (W.L.H.)

8999 NP-tr-80

THE FREEZING OUT OF VAPOURS FROM GAS–VAPOUR MIXTURES FOR THE CASE OF FORCED TUBULAR CURRENTS. Ernst A. Rische. Translated by N. Willis from Chem.-Ing. Tech. 29, 603-14(1957). 32p.

Investigations were carried out to determine on which quantities the density and thickness of a frost layer depend during freezing-out, how the surface of the frost is constituted, when snow or mist are produced, and when frost particles are merely carried away. As a system for investigation the nitrogen-benzene vapor mixture was studied. The results are compared with those given by other authors. (auth)

9000

THE STATIC ELECTRODE POTENTIAL BEHAVIOR OF TANTALUM AND ITS BEHAVIOR ON ANODIC POLARISATION. E. M. Khairy and M. Kamal Hussein (Univ. of Cairo). Bull. Chem. Soc. Japan 30, 944-9(1957) Dec.

A study of Ta static electrode potential is of importance for obtaining insight into its mode of oxidation leading to the observed resistivity. For this purpose, the electrode potential of tantalum was measured in buffer solutions covering the pH range 1 to 12 and initially free from its ions. Anodic polarization experiments by the repetitive oscillographic method were utilized in buffer solutions and in other different media. (J.E.D.)

9001

COMBUSTION OF METALS IN OXYGEN. A. V. Grosse and J. B. Conway (Temple Univ., Philadelphia). Ind. Eng. Chem. 50, 663-72(1958) Apr.

As part of a study of methods of producing high temperatures, the combustion of metals in oxygen was investigated. The basic objective was developing techniques to

produce and utilize high temperature sources. Metals which burn to produce high temperatures are discussed in terms of their location in the periodic table. The "skating sun" phenomenon suggests a high temperature radiation source. Metals are classified depending on whether they ignite above or below their melting point. The operating characteristics of powdered metal–oxygen flames are described in detail. The work reported is primarily fundamental research, although combustion of aluminum can yield a source of high intensity thermal radiation. Powdered metal-oxygen flames are highly effective in cutting through thick sections of concrete and various ceramic materials. (auth)

9002

LOW TEMPERATURE HEAT CAPACITIES AND ENTROPIES AT 298.15°K. OF SOME OXIDES OF GALLIUM, GERMANIUM, MOLYBDENUM AND NIOBIUM. E. G. King (Bureau of Mines, Berkeley, Calif.). J. Am. Chem. Soc. 80, 1799-1800(1958) Apr. 20.

Heat capacities of β-gallium oxide, germanium dioxide (soluble form), molybdenum dioxide and niobium dioxide were measured in the temperature range 51 to 298°K. All four substances gave normal heat capacity-temperature curves. The entropies at 298.15°K are, respectively, 20.31 ± 0.10, 13.21 ± 0.10, 11.06 ± 0.05 and 13.03 ± 0.07 cal/deg mole. (auth)

9003

HEAT CONTENTS ABOVE 298.15°K. OF OXIDES OF COBALT AND NICKEL. E. G. King and A. U. Christensen, Jr. (Bureau of Mines, Berkeley, Calif.). J. Am. Chem. Soc. 80, 1800-1(1958) Apr. 20.

High temperature heat content measurements of cobaltous oxide, cobalt spinel and nickelous oxide were conducted from 298°K to 1803, 999, and 1810°K, respectively. The heat content-temperature curve of nickelous oxide shows abrupt changes in slope at 525 and 565°K, indicating second-order transformations. A table of heat content and entropy increments above 298.15°K and heat content equations are included for use in thermodynamic calculations. (auth)

9004

THE SODIUM–DIBORANE REACTION. William V. Hough, Lawrence J. Edwards, and Albert D. McElroy (Callery Chemical Co., Penna.). J. Am. Chem. Soc. 80, 1828-9 (1958) Apr. 20.

The reaction of diborane with sodium amalgam in simple ethers yielded an equimolar mixture of sodium borohydride and NaB_3H_8. The new compound was characterized by X-ray, infrared and elemental chemical analyses and by its physical properties. A proposed reaction course involves intermediates of empirical composition $Na_2B_2H_6$ and NaB_2H_6. (auth)

9005

METAL-WATER REACTIONS. VI. KINETICS OF THE REACTIONS OF WATER VAPOR WITH STRONTIUM AND BARIUM. Harry J. Svec and H. Gene Staley (Iowa State Coll., Ames). J. Electrochem. Soc. 105, 121-5(1958) Mar.

Strontium and barium were reacted with water vapor and the kinetics determined in the temperature range 40° to 66°C for water vapor pressures from 17.5 to 92.5 mm Hg. The stoichiometry varied according to the reaction conditions. For the strontium reactions the products were H_2 and $Sr(OH)_2$. For vapor pressures below 44 mm the products of the barium reactions were H_2 and $Ba(OH)_2$ while for pressures above 44 mm they were H_2 and $Ba(OH)_2 \cdot H_2O$. Manometric and gravimetric methods were employed in the kinetic studies. Both the Sr and lower vapor pressure Ba reactions followed the parabolic rate law. At higher pressures the Ba reaction followed a linear law. An activation energy of –5.2 ± 0.2 kcal/mole was found for the Sr reactions. The activation energy for the Ba reactions was found to depend on reaction conditions. Higher temperature studies of the reactions between water vapor and Sr, Ba, and Ca indicated that in certain temperature ranges above 100°C completely protective coatings were formed similar to those observed in the oxidation of Al or Cr. (auth)

9006

REACTIONS OF RECOIL BROMINE ATOMS IN ALKALI BROMATES. Joseph Jach and Garman Harbottle (Brookhaven National Lab., Upton, N. Y.). Trans. Faraday Soc. 54, 520-5(1958) Apr.

An investigation has been made of the recoil and post-irradiation annealing reactions of Br^{80m}(4.6 h) and Br^{82}(35.8 h) in the crystalline alkali bromates. The retentions of both isotopes in sodium, potassium, rubidium, and cesium bromates are initially nearly the same but increase at different rates on annealing, the Br^{82} in each case increasing the more rapidly. Lithium bromate shows different behavior: the increase in retention on annealing is nearly the same for both isotopes. In addition, the radioactive recoil bromine in lithium bromate is found in the form of hypobromite ion as well as bromate and bromide. (auth)

9007

THE OXIDATION RATE OF MOLYBDENUM IN AIR. E. S. Bartlett and D. N. Williams (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 212, 280-1(1958) Apr.

In a recent program at Battelle, it became desirable to know more about the characteristic oxidation behavior of molybdenum under varying conditions of temperature and atmosphere. Using oxidation-test apparatus designed for dynamic, continuous recording of weight change during testing, values for the oxidation rate of molybdenum were obtained at temperatures from 1400 to 2150°F. In addition, the effect of air flow on oxidation rate was studied. The results of tests suggest that there is a maximum oxidation rate for molybdenum at a given temperature which is obtained when conditions are maintained such that the partial pressure of MoO_3 in the atmosphere surrounding the specimen is at a low value. (A.C.)

9008

OXIDATION OF ZIRCALOY-2 AND -3A AT 300 TO 850°C. E. A. Gulbransen and K. F. Andrew (Westinghouse Electric Corp., Pittsburgh). Trans. Met. Soc. AIME 212, 281-6 (1958) Apr.

The vacuum-microbalance method was used to study the oxidation behavior of Zircaloy-2 and -3A over the temperature range of 300 to 850°C and at 0.1 atm pressure. The results fit in well with the authors' earlier studies on zirconium. Tin was found to increase the rate of oxidation and also the temperature at which the metal burns. Both the cubic-rate law and the parabolic-rate law gave imperfect fits to the rate data. Since the parabolic-rate law has been derived from accepted physical principles, this rate law was used to interpret the rate data. A heat of activation of 28,600 cal per mole was calculated. The transition phenomenon previously observed in hot-water and steam-corrosion processes was studied systematically for oxygen atmospheres. Observations on the rate of oxidation, color and properties of the oxide films show that the transition phenomenon was associated with a failure in the adherence of the oxide to the alloy. (auth)

Analytical Procedures

9009 AF-SAM-58-21

Albert Einstein Medical Center. Radiology Dept., Philadelphia.

THE BEHAVIOR OF THE RADIATION PROTECTIVE

AGENT AET IN AQUEOUS BUFFERED SOLUTIONS AND HUMAN SERUM. Bernard Shapiro. Aug. 28, 1957. 17p.

A technic has been developed, utilizing S-35 labeled S,2-aminoethylisothiouronium bromide hydrobromide (AET) and paper chromatography, for identifying the form in which the protective agent exists in aqueous solutions. The products of AET dissolved in solutions of varied pH, temperature, and age were AET, a compound at R_f 0.48, a sulfhydryl compound, and disulfide. The concentrations of these compounds varied, depending on the conditions in the solution. Irradiation of the sulfhydryl form produced disulfide, and irradiation of the disulfide produced additional unidentified products. Crystalline AET added to serum yielded the three other products observed in buffered solutions and a protein-bound compound. When the sulfhydryl and disulfide forms were added to serum, only the disulfide and a protein-bound compound appeared. It is suggested that the compound administered may not be the form which protects and it is necessary to know the latter in order to discover the mechanism of protection. (auth)

9010 CEA-698

France. Commissariat à l'Energie Atomique, Paris.

DOSAGE DU NICKEL DANS LE ZIRCONIUM ET DANS LE ZIRCALOY. (Quantitation Analysis of Nickel in Zirconium and Zircaloy.) M. Restoix. July 2, 1957.

A rapid spectrophotometric method has been developed for determination of 10 to 1000 ppm of Ni in zirconium and zircaloy using dimethylglyoxime. Iron, copper, tin and chromium do not interfere at the concentration usually present in zirconium and its alloys. (auth)

9011 CF-56-7-106(3rd Issue)

Oak Ridge National Lab., Tenn.

NEUTRON ACTIVATION ANALYSIS. G. W. Leddicotte and S. A. Reynolds. Apr. 22, 1958. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The development of nuclear reactors has given the analyst a new analysis method which can be successfully applied to the determination of microgram and submicrogram quantities of many elements. Known as "activation analysis," this method is one in which an "activation" by some type of nuclear reaction is used to produce a radioactive isotope of the element to be determined. Since this radioisotope decays with its own characteristic radiations and half life, it is possible to make activation analysis a very specific analysis. Chemical separations of the radioisotope are employed whenever necessary and its radioactivity measured by some type of radiation counter. Of all the nuclear reactions, the neutron reactions have been used most often in activation analysis. The most useful neutron reaction, the (n,γ) reaction, involves the capture of a neutron by a stable nucleus to produce a radioisotope of the original atom. Since the Oak Ridge reactors are prolific sources of (n,γ) reactions, it has been possible to use activation analysis in many applications requiring an analytical method of great sensitivity and specificity. This paper briefly describes the program of neutron activation analysis service at Oak Ridge National Laboratory. The techniques used in this work and the limits of measurement and general applications of the method are also discussed. (auth)

9012 IGO-AM/W-167

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

THE DETERMINATION OF 210 POLONIUM IN URINE AND OTHER BIOLOGICAL MATERIALS. Mar. 1958. 7p.

Organic matter is destroyed by wet oxidation, and polonium is co-precipitated with tellurium carrier by reduction with sodium hypophosphite. The precipitate is dissolved and tellurium is removed by precipitation using hydrazine hydrochloride. After electrochemical deposition from solution on to silver foil the activity due to 210 polonium is determined in an alpha scintillation counter. (auth)

9013 LMSD-2312

Lockheed Aircraft Corp. Missile Systems Div., Sunnyvale, Calif.

AN EVALUATION OF TECHNIQUES FOR THE ANALYSIS OF OXYGEN IN BERYLLIUM. Wanda G. Bradshaw. Mar. 14, 1958. 43p. Contract NOrd-17017.

A survey of possible methods of analyzing for oxygen in beryllium was made, and the principles of the various methods are described. Where available, numerical results obtained by various methods and by different laboratories are compared. The advantages of the possible methods and their probable sources of error are discussed. Finally on the basis of these studies, recommendations for the most reliable methods and those showing greatest promise for trace analysis are made. (auth)

9014 NBL-143

New Brunswick Lab., AEC, N. J.

SEMIANNUAL PROGRESS REPORT FOR THE PERIOD JULY 1957 THROUGH DECEMBER 1957. C. J. Rodden. Apr. 1958. 81p. $2.25(OTS).

Studies are reported on the following methods of analysis and determination: spectrophotometric determination of B in U_3O_8 with 1,1-dianthrimide; colorimetric determination of Ag in U and BeO with dithizone; spectrophotometric determination of Br in UO_3, UF_6, and UF_4; separation of trace amounts of rare earths from various metals; flame photometric determination of Na in uranium ores; determination of U^{235} using gamma scintillation spectrometry; determination of U^{235} by neutron activation; radiometric determination of U^{234} in U; spectrochemical determination of U^{235}; volumetric determination of U_3O_8 in Th sludge; and separation of analyzed BeO spectrochemical reference samples. (For preceding period see NBL-139.) (W.L.H.)

9015 NP-6675

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

SCHNELLE SPEKTROCHEMISCHE BESTIMMUNGS-METHODE VON BORIUMSPUREN IN GRAPHITEN UND KOKSEN VERMITTELS DER STREUUNG DER PROBEN IM FUNKEN. (Fast Spectrochemical Method of Analysis for Trace Amounts of Boron in Graphite and Coke by Means of Powder Spark Method.) Report No. 2/VNA. J. Czakow and T. Steciak. Nov. 1957. 11p.

A simple and fast method for the determination of boron in graphite and coke is described. A concentration sensitivity of the same order as in the direct method was obtained and with simpler means and less time. The accuracy and range could be improved by use of constant sparking of a powdered sample in the discharge chamber and by introduction of a background correction. In the case of samples containing over 0.1% iron, one should use a spectrograph with great dispersion to avoid a coincidence of the iron 2497.82 A and boron 2497.73 A lines. (tr-auth)

9016 NP-6676

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

SPEKTROGRAFISCHE BESTIMMUNG VON LITHIUM-SPUREN IN METALLISCHEM CALCIUM IM FUNKEN. (Spectrographic Determination of Trace Amounts of Lithium in Metallic Ca by Spark Method.) Report No. 3/VNA. J. Czakow and E. Weźranowski. Nov. 1957. 9p.

A method is described for the determination of lithium traces in metallic calcium by means of emission spectral analysis. The determination is accurate in the range 3 to 10 ppm of lithium. The reproducibility of the results calculated according to the formula $v = t \cdot s/x \cdot 100\%$ is ± 4%

for p = 95%. A spark source of high voltage was used. The sample was constructed of calcium chloride and pelleted with graphite. The exposure was made with a Hilger monochromator, type D187, on Ilford long-range spectrum plates. The standard curve was formulated. No background correction was introduced. (tr-auth)

9017 NP-6681

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

DETERMINATION OF TRACE AMOUNTS OF BUTANOL IN TRI-N-BUTYL PHOSPHATE BY THE FLOAT METHOD. Report No. 10/IV. W. Korpak and K. Majchrzak. Feb. 1958. 11p.

A method was developed for the determination of small amounts of butanol present in tri-n-butyl phosphate in concentrations ranging between 0.05 and 0.5%. The method involves distillation of butanol with water vapor, determination of the temperature of equilibrium between distillate and glass float, and reading of results from a standard diagram. By using a multiplying factor of 1.12, an accuracy of ± 2.3 per cent was obtained. (auth)

9018 NP-6689

Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.

DETERMINATION OF OXYGEN IN NIOBIUM. Research Report 6-94602-9-R13. William F. Harris. Aug. 2, 1957. 10p.

A platinum bath was found to be useful in the determination of oxygen in niobium by vacuum fusion. The results obtained are consistent and independent of sample size. (auth)

9019 USNRDL-TR-225

Naval Radiological Defense Lab., San Francisco.

NEW TECHNIQUES IN RADIOCHEMICAL DETERMINATIONS THROUGH POLAROGRAPHIC METHODS. D. L. Love. Mar. 31, 1958. 25p.

An application of the polarograph to the analysis of radionuclides in fission product mixtures is proposed. The primary requirements of the method are that the radionuclides be reducible to the zero oxidation state, amalgamable with the dropping mercury, and removable from solution for assay. Experiments were carried out to investigate these requirements and also other conditions which must exist if the proposed method is to be feasible. The experimental results indicate that the proposed application of the polarograph to analysis of fission product radionuclides is both feasible and valid. The results suggest that development of the proposed method would result, in many instances, in more rapid radiochemical analyses. (auth)

9020 WAPD-PWR-CP-2728

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

A NEW INSTRUMENTAL METHOD FOR MEASURING THE CONCENTRATION OF DISSOLVED HYDROGEN IN WATER. J. M. Wright and D. J. Stiteler. [Feb. 1957]. 60p. $9.30 (ph OTS); $3.60(mf OTS).

Data are presented on a new instrumental method for measuring the concentration of hydrogen gas dissolved in water. The method is based on the fact that the electrical resistance of palladium metal is changed when it is in contact with water containing dissolved hydrogen. The amount of this change depends on the concentration of dissolved hydrogen. The response of the instrument is rapid enough so that no preheater is needed to raise the temperature of the water. No associated vacuum system and pressure measuring device are needed. The unit is small, rugged, inexpensive, and requires only a low water flow rate (0.05 gpm). The platinum wire included in the device as a resistance compensator can serve as a resistance thermometer to indicate the temperature of the water. (J.S.R.)

9021 Y-1194

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

THE VOLUMETRIC DETERMINATION OF URANIUM IN THE PRESENCE OF MOLYBDENUM. W. C. Dietrich and J. M. Schreyer. Mar. 18, 1958. 9p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

A method has been developed for the determination of uranium in the presence of molybdenum. The method involves a collective determination of molybdenum and uranium by a zinc amalgam reduction and dichromate oxidation in a phosphoric–sulfuric acid medium. The dichromate equivalent to uranium is obtained by applying a correction based on an independent spectrophotometric method for molybdenum. (auth)

9022 AEC-tr-3205

A SEPARATION METHOD IN A SINGLE DROP. A Contribution to the Spot Analysis (with Three Photos). Herbert Weiss. Translated by Lydia Venters from Mikrochim. Acta. 376-87(1954). 12p.

With the aid of the ring furnace method, it has been possible to work out a method of separation for ions of the following elements: Pb, Bi, Cu, Cd, Sn, Sb, Fe, Co, Ni, Mn, Cr, Zn, Al, and Ti. A drop of about 1.5 μl is sufficient for the analysis, provided the amounts of the cations present still permit the identification reactions. The ions are separated into four groups, designated as ring I, II, III, and fleck. The detection reactions are conducted on the paper with the aid of familiar reactions, which have been modified for this purpose. Four examples are cited, employing 35 μg or less. The analysis requires about one hour. (auth)

9023 AEC-tr-3206

THE RING FURNACE METHOD. A Contribution to the Spot Analysis (with Four Photos). Herbert Weiss. Translated by Lydia Venters from Mikrochim. Acta, 667-81 (1956). 15p.

The ring furnace, a heating block, which carries an aperture in its center, serves for the washing of soluble materials from a precipitate fixed on filter paper and to concentrate them in a narrow zone. A glass device serves for the precipitation with gaseous reagents in a test drop on paper. The reagent is sucked through the filter and the precipitation is very fast and quantitiative. Since a free zone lies between the precipitate left in the center and the ring after the soluble materials have been washed out, the precipitate can be cut out with a punch. The substances on the small paper disk can be separated into still other groups after appropriate preliminary treatment. Consequently it is possible to divide the materials present in a single drop of test solution into several groups and to identify them. The ring furnace method further makes it possible to conduct semi-quantitative analyses. These require only about 2 μg of the ion to be determined. (auth)

9024

NEUTRON ACTIVATION ANALYSIS OF BLOOD. Richard P. Spencer, Thomas G. Mitchell, and E. Richard King (United States Naval Hospital, Bethesda, Md.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 1053-62 (1958) June.

The application of neutron activation analysis to quantitation of anions and cations in blood is discussed utilizing a flux of 2.5×10^8 neutrons/cm^2/sec. This flux can be obtained by the use of radium-beryllium sources, Van de Graaff-beryllium systems, and nuclear reactors. The time of irradiation is only one hour, and the technique is nondestructive to the specimen. Thirteen isotopes are theo-

retically produced to the extent of 30 dpm or greater following the exposure of 10 ml plasma to this flux for one hour. These isotopes represent six cations (sodium, magnesium, potassium, copper, zinc, calcium) and four anions (chlorine, iodine, bromine phosphorus). Hence, if complete delineation were possible, ten electrolytes in blood could be estimated by neutron activation analysis at this low flux. In addition, isotopes of cobalt and manganese may be at the limit of detection. Each of the isotopes produced to the extent of 30 dpm or greater, with the exception of P^{32} and Zn^{69}, gives off gamma rays during its disintegration. All of the radionuclides produced to this extent, except Br^{80m}, emit beta rays. The applicability of gamma ray and beta ray spectroscopy, in distinguishing between these isotopes, is discussed. In addition, differences in half-life may enable certain of the isotopes to be detected after more short-lived components have been dissipated. Emissions from Na^{24} and Cl^{38} tend to dominate the gamma ray spectrum of neutron irradiated blood. Hence, sodium and chlorine may be estimated directly by activation analysis. Techniques of separating other radioisotopes present in the sample, to eliminate sodium and chlorine, are discussed. Neutron activation analysis may be directly applicable to the determination of red blood cell composition, since these cells have a low content of sodium and chlorine, and can be obtained relatively free from plasma. Applications to tissue analysis are also pointed out. (auth)

9025

THE DETERMINATION OF OXYGEN IN BERYLLIUM BY THE MICRO VACUUM FUSION METHOD. E. Booth and A. Parker (United Kingdom Atomic Energy Authority, Woolwich, Eng.). Analyst 83, 241-2(1958) Apr.

An improvement of the method previously presented for determination of oxygen in beryllium by the micro vacuum fusion method (Analyst 82, 57(1957)) is discussed. In this method a quantity of tin is added to the reaction to suppress beryllium evaporation. (J.R.D.)

9026

NEUTRON ACTIVATION, AN ULTRASENSITIVE ANALYTICAL TOOL. Herman Cember (Univ. of Pittsburgh). Arch. Ind. Health 17, 527-32(1958) May.

Neutron activation analysis provides a simple method of detection and measurement of certain trace elements. Sensitivity of the method is determined intrinsically by the neutron activation cross section and extrinsically by the thermal neutron flux in the reactor. The method is applicable only to those elements whose activated radioisotopes have half-lives that are at least of the same order of magnitude as the time between termination of irradiation and measurement. (auth)

9027

QUANTITATIVE SPECTROSCOPIC ANALYSIS OF A GASEOUS MIXTURE OF HYDROGEN, DEUTERIUM AND TRITIUM. M. N. Oganov and A. P. Striganov. Atomnaya Energiya 3, No. 8, 112-20(1957).

Gaseous mixtures of hydrogen and deuterium or hydrogen and tritium can be analyzed quantitatively by means of a three-glass prism spectrograph. It was established that the intensity ratio I_H/I_D depends on the gas pressure in the discharge tube. With a concentration of 10.2% hydrogen, the intensity ratio remains constant with any modification of the gas pressure. With higher or lower concentrations of hydrogen, the ratio increases with increasing gas pressure. A quantitative analysis is also possible for a gaseous mixture containing hydrogen, deuterium, and tritium. (J.S.R.)

9028

DETERMINATION OF THE NATURALLY RADIOACTIVE ELEMENTS USING A LABORATORY RADIOMETER. I. M. Nazarov. Atomnaya Energiya 3, No. 8, 121-9(1957).

On the basis of 24 citations from published works the author shows what systems of equations must be solved for the various known methods in order to determine the natural abundance of U, Th, Ra, and K. The known methods which can be carried out with a normal radiometer are based upon: (a) measuring different kinds of radiation, (b) discrimination of a type of radiation, (c) use of additional emanation measurements, (d) combination of the measurements mentioned under (a) and (b). (TCO)

9029

THE PHOSPHATE-OXYQUINOLINE SEPARATION METHOD AND THE VOLUMETRIC DETERMINATION OF ZIRCONIUM. A. V. Vinogradov and V. S. Shpinel'. Atomnaya Energiya 3, No. 8, 130-4(1957).

The newly developed method is based upon the well known phosphate method for the separation of zirconium and the determination of zirconium as oxyquinolate. It is explained how zirconium oxyquinolate is separated from an oxalate-containing solution after the phosphate precipitation was dissolved in oxalic acid. The conditions are given for the separation of zirconium from titanium and thorium in the phosphate precipitation and from niobium and tantalum in the oxyquinolate precipitation. By means of this method it is possible to determine small quantities of zirconium (2 to 5 mg) with an accuracy of up to ± 2 to 4%. (TCO)

9030

MEASUREMENT OF SMALL α-EMITTER CONCENTRATIONS IN WATER BY FREEZING-OUT. N. G. Gusev, D. P. Osanov, and V. P. Mashkovich. Atomnaya Energiya 3, No. 10, 346-50(1957).

The following effect was used to measure α contamination in water. The contaminated water is poured into a receptacle and frozen at −60°C. The layer of water frozen last will show an increase in activity. If K is the measure of enrichment, $K = N/N_0$, where N is the number of alpha particles emitted from the surface of the frozen layer and N_0 is the number emitted from the surface of the liquid. K does not change over a wide concentration range. The dependence of K on the freezing temperature and the water height was determined. K attains its highest value when the water approaches the purity of distilled water. (J.S.R.)

9031

FLAME PHOTOMETRIC DETERMINATION OF LITHIUM IN DIFFERENT ORGANIC SOLVENTS. Damjana D. Vukanović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 43-51(1958) Mar.

The influence which some physicochemical properties of the solvent can have on the flame photometric determination of elements has been discussed in the case of LiCl in various organic solvents. A considerable increase of the sensitivity has been observed. The possibility of a general improvement of the working conditions is clearly shown. (auth)

9032

POLAROGRAPHIC DETERMINATION OF RUTHENIUM. Milenko V. Šušić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 54-7(1958) Mar.

The polarization curve of the mixture of $Ru^{3+} + Ru^{4+}$ was investigated on the dropping mercury electrode at different pH values in 0.9M $HClO_4$, 0.1M complexone II, and 0.05M complexone II + 0.5 ammonium acetate as supporting electrolytes. The polarization curve consisted of three separated waves, which are actually catalytic waves of hydrogen. The height of the waves, half-wave potentials, and total polarization curve depended on the pH value of the solution. For some pH values $i_d/C = k$. Therefore ruthenium can be determined at very low concentrations. (auth)

9033

MEDICAL APPLICATIONS OF NEUTRON ACTIVATION ANALYSIS. Richard P. Spencer, Thomas G. Mitchell, and E. Richard King (U. S. Naval Hospital and National Naval Medical Center, Bethesda, Md.). Intern. J. Appl. Radiation and Isotopes 3, 104-12(1958).

Neutron activation analysis, employing low flux intensities has been adapted to the estimation of anions and cations in biologic specimens. A flux of this magnitude is obtainable from Van de Graaff-beryllium sources, radium-beryllium systems, as well as nuclear reactors; hence the techniques should be technically feasible for a number of laboratories. Following exposure of 10 ml serum to such a flux for one hour, 15 radioisotopes are produced to the extent of 30 dpm or greater. The isotopes represent 8 cations (Na, K, Ca, Cu, Zn, Mg, Co, Mn) and 4 anions (Cl, Br, I, P). Methods of separating the isotopes, and distinguishing them by beta and gamma ray spectroscopy are discussed. Radiosodium (Na^{24}) is the principal gamma ray emitting isotope produced in blood; it may be readily produced and estimated with fluxes of 10^6 or even lower. The necessity of removing radiosodium in order to estimate isotopes present in only trace quantities is stressed. Applications to the nondestructive analysis of tissues, red cells, and other biologic specimens are discussed. (auth)

9034

USE OF A PULSE DISCRIMINATOR ATTACHED TO A GAMMA SCINTILLATION DETECTOR FOR ACTIVATION ANALYSIS. R. Chauvin and P. Leveque. Intern. J. Appl. Radiation and Isotopes 1, 115-22(1956). (In French)

The principle of the method, the apparatus, and the limitations it imposes are first considered. The quantitative determination, without chemical separation, of the three elements which lend themselves particularly well to this technique because of the high energy of their γ emission, is then described. It is possible to detect 1 microgram of sodium or aluminum with a flux of 10^{11} n/cm^2/sec and 100 milligrams of thorium, the sensitivity depending on the discriminator threshold. The precision may be as good as 1% in the most favorable cases but is generally about 5%. Some possibilities of development of this method are then discussed. (tr-auth)

9035

ISOTOPIC ANALYSIS OF OXYGEN IN WATER. M. Anbar (Weizmann Inst. of Science, Rehovoth, Israel). Intern. J. Appl. Radiation and Isotopes 3, 131-4(1958).

A semimicro method for the oxidation of water to oxygen for mass spectrometry has been developed. Water samples of 25 to 100 mg are oxidized by bromine in alkaline solution in presence of cobaltic oxide. (auth)

9036

CHROMATOGRAPHIC TECHNIQUES FOR SEPARATION OF IODINATED THYROID PRODUCTS FROM HUMAN URINE. E. I. Shaw and R. Goldsby (Univ. of Kansas, Lawrence). Intern. J. Appl. Radiation and Isotopes 3, 161-5(1958).

The low concentration of iodinated thyroid products in human urine necessitates either the concentration of these compounds or the application of large volumes of urine to papers for the production of paper partition chromatograms. Present day techniques of electrolytic desalting or separations on ion exchange resins are not practicable in this case. Too large a fraction of the low molecular weight iodinated compounds are lost through electrolytic desalting in addition to partial deiodination of some of the compounds. Thicker than ordinary membranes partially eliminates the former effect. The possibility of loss of small quantities of unknown compounds is always present when ion exchange resins are used. Water saturated butanol extraction of urine for concentration of the iodinated compounds is less dangerous when the residual urine or fresh urine is also chromatographed for comparison. Unfortunately, butanol extracts also concentrate many of the organic and inorganic compounds which interfere with the flow of the iodinated thyroid products so they have disadvantages similar to those in applying large volumes of urine to the papers. Two dimensional chromatography diminishes the need for removal of interfering substances such as urea and inorganic salts. Through use of the proper solvents, the iodinated compounds can be chromatographed free of the interfering substances in the first dimension and subsequently separated from each other by the use of a different solvent in the second dimension. Volumes of urine as large as 1 ml have been applied to 18 × 22 in. papers and reasonably good separations obtained. Much oxidation and artifact formation takes place in butanol–dioxane ammonia solvents, but this is partly controlled with cyanide. Pure amino acids and thyroid hormones on paper chromatograms in the presence of iodide are more subject to oxidation and exchange of I^{131} for stable iodide than the same compounds on chromatograms of urine. (auth)

9037

A SIMPLIFIED PROCEDURE FOR PROPORTIONAL COUNTING OF C^{14}-LABELED CARBON DIOXIDE. Linda Simpson (Kettering-Meyer Lab., Birmingham, Ala.). Intern. J. Appl. Radiation and Isotopes 3, 172-5(1958).

A simplified procedure is described for proportional counting of C^{14} -labeled carbon dioxide which has proved to be a convenient method for the routine assay of samples of widely varying size, nature, and specific activity. A diagram of the apparatus is included. (C.H.)

9038

THE DETERMINATION OF THE OXYGEN CONTENT OF SODIUM METAL BY THE BUTYL BROMIDE METHOD. L. E. Smythe and H. J. de Bruin (Australian Atomic Energy Commission, Sutherland, N. S. W.). 242-4(1958) Apr.

An accurate acidimetric end point detection, required for micro determination of oxygen in sodium metal by the butyl bromide method, is described. (J.R.D.)

Crystallography and Crystal Structure

Refer also to abstract 9158.

9039

ON THE EXISTENCE OF TWO CRYSTALLINE VARIETIES OF ZIRCONIUM TETRAFLUORIDE. André Chrétien and Bernard Gaudreau. Compt. rend. 246, 2266-8(1958) Apr. 14. (In French)

A study was made of the thermal dissociation of ammonium zirconium heptafluoride. The heptafluoride, heated in an inert atmosphere, is pyrolyzed to the hexafluoride. The pentafluoride is obtained pure from the hexafluoride at 150°C, and ZrF_4 is obtained at 330°C. An x-ray study of the zirconium fluoride shows the existence of two crystalline forms. αZrF_4, obtained below 405°, is changed to the β form if it is heated above this temperature. Condensation of the vapor emitted by either form on a cold plate results in the α form; if the vapor is condensed on a hot plate, the β results. (J.S.R.)

9040

UO_2–PuO_2 SOLID SOLUTIONS. Robert N. R. Mulford and F. H. Ellinger (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 80, 2023(1958) Apr. 20.

An X-ray-diffraction investigation has been made of the solid phase relationships in the UO_2–PuO_2 system. The

results show that a continuous solid solution exists, and that the lattice parameter varies essentially linearly with composition. A slight negative deviation from linearity may exist. (auth)

Deuterium and Deuterium Compounds

9041
A NEW BALANCING DROP METHOD FOR THE DETERMINATION OF THE DENSITY OF HEAVY WATER. Yoshihide Naito (Tokyo Metropolitian Univ., Setagaya). Bull. Chem. Soc. Japan 30, 939-40(1957) Dec.

A new method is reported in which the drop of the sample water is brought to balance in the liquid medium by changing the temperature of the latter as in the case of the float method. Thus the density of the sample can easily be known from the temperature dependence of the density of the medium liquid. (J.E.D.)

9042
DISTRIBUTION OF HYDROGEN ISOTOPES IN DEUTEROMETHANES IN ELECTRICAL DISCHARGE AND AT HIGH TEMPERATURE. Natalija N. Dogramadži, Vukica M. Radak, and Vladimir M. Vukanović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 85-8(1958) Mar.

The distribution of hydrogen isotopes in deuteromethanes obtained from monodeuteromethane in electrical discharge and in a heated quartz tube at 1000°C has been examined. A difference in the distribution of deuterium in various deuteromethanes has been noticed. In the electrical discharge the formation of CH_2D_2 is preferred. (auth)

Fluorine and Fluorine Compounds

Refer also to abstract 9553.

9043 CF-58-3-44 and CF-58-5-17
Oak Ridge National Lab., Tenn.
A PRELIMINARY SURVEY OF SOME FLUORIDE COMPOUNDS. [PARTS] I AND II. L. A. Harris. (Pt. I, Mar. 10, 1958. 2p. and Pt. II, May 14, 1958. 3p.) Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS) ea.

These two parts were issued separately, but are cataloged as a unit.

The two compounds $Na_5U_3F_{17}$ and $Na_3Th_2F_{11}$ were found to have a face-centered cubic structure. From parameter dimensions and intensity values these two compounds appear to be isomorphous. $Na_5U_3F_{17}$ has an identical cell size with α-Na_2UF_6. A group of three compounds (Rb_2ThF_6, Rb_2ZrF_6, and $CsZrF_6$) were reliably identified as being uniaxial by use of their optical properties. These compounds were tentatively indexed on the basis of data obtained from powder x-ray spectrometer patterns found to best fit a hexagonal unit cell. (W.L.H.)

9044 WADC-TR-56-590(Pt. II)
Colorado. Univ., Boulder.
PHOTOCHEMICAL SYNTHESIS OF ORGANIC FLUORINE COMPOUNDS. Period Covered: November 15, 1956 to September 14, 1957. Joseph D. Park and John R. Lacher. Sept. 14, 1957. 34p. Project title: RUBBER, PLASTIC, AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-3266. (AD-151014).

The purpose of this research work has been to synthesize organic and organometallic fluorine compounds with the major objective of obtaining monomers suitable for polymerization into elastomers, plastics, fluids, and related material of high thermal and chemical stability. In conjunction with these aims, a number of diols and cyclic fluorosilanes has been synthesized. At the present time, the structures assigned to several of the synthesized fluorosilanes have not been verified. Further work in the preparations of cyclic diols involving the dimerization reaction of fluoroölefins with alkenes containing functional groups has produced intermediates with interesting fluorescent properties. Initial investigation has been made of obtaining a monomeric unit with fluorine substitution on the aromatic nucleus. (auth)

9045
INVESTIGATION OF THE VIBRATIONAL SPECTRA OF MOLECULAR COMPOUNDS OF BORON TRIFLUORIDE WITH NITROGEN AND OXYGEN CONTAINING SUBSTANCES. I. $F_3B \cdot NH_3$ AND $F_3B \cdot ND_3$. A. A. Babushkin, I. F. Kovalev, and V. M. Emel'yanova (Moscow State Univ.). Optika i Spektroskopiya 4, 468-73(1958) Apr. (In Russian)

Vibrational spectra for molecular compounds $F_3B \cdot NH_3$ and $F_3B \cdot ND_3$ were investigated. The field forces of these compounds were calculated, and the observed frequencies were identified with certain vibrational forms of the compounds. To check the accuracy of the results, supplementary studies were made of the BF_3 compounds with incompletely deuterized ammonia. (tr-auth)

Graphite

Refer also to abstracts 9462 and 9507.

9046 BMI-1261
Battelle Memorial Inst., Columbus, Ohio.
THE COMPATIBILITY OF A NUMBER OF METALS AND ALLOYS WITH GRAPHITE. Arnold F. Gerds and Manley W. Mallett. Apr. 14, 1958. 30p. Contract W-7405-eng-92. $4.80(ph OTS); $2.70(mf OTS).

The interaction between graphite and a number of metals and alloys was studied at 1850°F in 250-hr tests. Some materials were also tested at 1650 and 1850°F in 1000-hr tests. The graphite was heated in intimate contact with the test metal in welded metallic capsules. The extent of the reaction was judged on the basis of metallographic examinations and hardness traverses on cross sections of the reacted elements. Copper was the least reactive material tested in contact with graphite. Nickel was only slightly more reactive. Outside of a very hard carbide band at the graphite-metal interface, no evidence of interaction of carbon with molybdenum was found. Inconel X was the most compatible alloy tested in contact with graphite, although some pickup was observed. Alnicro was the next best alloy. Nichrome V, Inconel, and Types 316 and 318 stainless steels were all much more reactive. Copper and chromium plating reduced the rate of diffusion of carbon into Type 316 stainless steel. Nickel plating was less effective for this purpose. (auth)

Laboratories and Equipment

Refer also to abstract 8958.

9047 RFP-97
Dow Chemical Co. Rocky Flats Plant, Denver.
ABSOLUTE AIR FILTERS—FLAMMABILITY AND FIRE CONTROL STUDIES. P. D. Erickson and F. J. Linck, Jr. Mar. 17, 1958. 31p. Contract AT(29-1)-1106. $6.30 (ph OTS); $3.00(mf OTS).

A study was made of the ignition characteristics and methods of controlling or extinguishing fires in CWS-6 type filters. Air flows ranged from 250 to 560 cfm per filter, which is the range encountered in a building ventila-

tion system. Ignition of a filter was attempted by introducing welding sparks or burning paper into the air stream. The welding sparks had no effect; however, the burning paper rapidly ignited the filter. Large quantities of smoke were given off immediately when the filter began burning. Ignition of this smoke caused mild explosions during several of the tests. The explosive nature of the smoke might present a greater hazard than the fire itself. A water fog spray was found to be the best means of controlling the fire when conditions prevented the use of large quantities of water. It also reduced the explosion hazard by preventing ignition of the smoke. The water fog reduced the burning rates significantly at both high and low air flows. (auth)

9048

HEAVY-DUTY REMOTE TONGS FOR THE RADIOACTIVE ISOTOPE LABORATORY. L. E. Preuss (Edsel B. Ford Inst. for Medical Research, Detroit). Intern. J. Appl. Radiation and Isotopes 3, 176-7(1958).

Remote tongs were designed for use in opening the lead-shielded shipping containers for radioactive materials employed by the AEC and secondary suppliers. Design criteria include an adequate handle to remove the operator from proximity to the source and provide leverage for the heavy shield; an actuating mechanism driven from the operator's end; a compact dropped-head allowing insertion into boxes and over shields; a foolproof lock; a grasping mechanism adaptable to a variety of forms; lightness, ease of disassembly, and strength to carry up to 100 lb loads; and an engaging design which will not mar, or distort, the shield surface. (C.H.)

9049

AN INVESTIGATION OF SOME NEW CATHODE DEPOLARIZER MATERIALS. A. B. Tripler, Jr. and L. D. McGraw (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 105, 179-83(1958) Apr.

A stable trivalent manganese compound, manganic phosphate, has been found to have good cathode depolarizer properties in strongly acid electrolytes. Manganic phosphate-carbon cathodes of the type used in this work delivered up to 8.5 amp-min per gram of $MnPO_4$. This corresponds to over 80% utilization. When coupled with lead in excess fluoboric acid electrolyte, the watt-minute capacity per gram of $MnPO_4$ was 8. The electrochemical behavior, and charge retention of the cathodes are described. Manganic phosphate and another less stable depolarizer, barium ferrate, furnish cathodes which can be discharged at 200 ma/in.^{3} (16.4 cc) without severe polarization. The maximum nonpolarizing currents for the $MnPO_4$ are discussed in terms of the surface area of carbon admixed with it to form cathodes. The depolarizing properties of a strongly oxidizing, insoluble organic compound chloranil are reported. (auth)

9050

A VERSATILE HEAVY-DUTY POWER MANIPULATOR. J. A. Marsh (A. C. Wilson and Partners, Ltd.). Nuclear Eng. 3, 207-9(1958) May.

This manipulator was originally developed to meet the need for remote handling of bulky, heavy, and complex experimental liquid-cooled fuel element loops after irradiation. Because of inherent multi-joint complexities, the wrist motion has been omitted from the main body and incorporated into some of the separate heads (including horizontal and vertical box spanners, drilling heads, single and double motion jaws, slitting and grinding tools, etc.). The manipulator will lift a load of 2,240 lb, exert a downwards thrust of 1½ tons, exert a force of ⅜ ton in any direction parallel to the floor with the telescopic tube assembly fully extended, provide a turning force of moment of 5,000 lb-in. about its vertical axis, and each power take off will give an output torque sufficient to shear the head off a ½ in. diam. bolt. (W.D.M.)

Molecular Structure

9051 NYO-7547

Tufts Coll., Medford, Mass.

X-RAY DIFFRACTION STUDIES OF THE HYDRIDES OF ZIRCONIUM, TITANIUM, AND HAFNIUM AT ELEVATED TEMPERATURES. Period Covered: January 1957 to January 1958. Edward J. Goon and Joseph Malgiolio. Apr. 1, 1958. 26p. Contract AT(30-1)-1355. $4.80(ph OTS); $2.70(mf OTS).

X-ray-diffraction data have been obtained for the hydrides of titanium, zirconium, and hafnium from room temperature to 650°C and at hydrogen gas pressures from 2 mm to 600 psi. No new hydride phases were observed. Evidence has been obtained in support of the work of Vaughan that the various phases previously reported for zirconium hydride are derived from the tetragonal phase with the axial ratio, c/a, less than one. When hydrogen is slowly removed from $\epsilon - ZrH_2$ (c/a < 1), the axial ratio increases to and may pass through unity. Hafnium hydride transforms from a tetragonal to the cubic phase in the same manner as does zirconium hydride. The lattice parameter of cubic hafnium hydride ranges from 4.722 to 4.719 A, and from 4.717 to 4.714 A; the parameters are both temperature and pressure dependent. The only hydride phase observed for titanium hydride is the face-centered cubic phase. The anomalous variation of lattice parameter of titanium hydride with temperature at constant pressure may be attributed to a change of some of the hydrogen positions from the tetrahedral sites to the octahedral sites of a fluorite type lattice. (auth)

Radiation Chemistry

9052 NP-tr-71

CHEMICAL CHANGES IN UNTREATED AND MODIFIED WOOL BY MEANS OF REACTOR RADIATION AND Co^{60} GAMMA RADIATION IN THE PRESENCE OF ATMOSPHERIC OXYGEN. E. R. Gritze, H. Pfannmüller, and H. Zahn. Translated by R. S. Forsyth from Angew. Chem. 69, 302-7(1957). 20p.

Untreated and chemically modified wool was exposed to Co^{60} gamma radiation or reactor radiation (in the presence of atmospheric oxygen). Water vapor absorptivity, alkali solubility, cysteinic acid increase, tyrosine and tryptophan degradation, increase of the ammoniacal nitrogen and of the water soluble nitrogen, and also the mechanical fiber damage indicate that there are preferred points of attack on the wool keratin by radiations of high energy. A definite stabilization against the effect of radiation can be attained by the addition of aromatic groups. (auth)

9053 SCL-T-180

QUANTITATIVE STUDIES OF RADIO-CHEMICAL REACTIONS. III. OXIDATION OF FERROUS SULPHATE BY BETA PARTICLES. (Etudes Quantitatives des Reactions Radiochimiques. III. Oxydation du Sulfate Ferreux par les Particules Beta.) D. M. Donaldson and N. Miller. Translated by M. I. Weinreich from J. chim. phys. 52, 578(1955). 4p.

The effect of beta particles, emitted by dissolved phosphorus, on an 0.8N sulfuric acid solution of ferrous sulfate in equilibrium with the air was studied. The absolute yield of the ferrous ion oxidation was measured and found to be 15.4 ± 0.8 ferric ions per 100 ev absorbed. (J.S.R.)

9054

IRRADIATION OF POLYETHYLENE. II. KINETICS OF

UNSATURATION EFFECTS. Malcolm Dole, D. C. Milner, and T. F. Williams (Northwestern Univ., Evanston, Ill.). J. Am. Chem. Soc. 80, 1580-8(1958) Apr. 5.

By studying three different types of polyethylene, it can be shown that the original unsaturation in the material whether vinyl or vinylidene disappears initially according to a first-order law and that the rate then becomes less than first order as the trans-vinylene concentration builds up. A protective action of vinyl groups by vinylene groups is postulated to explain the pronounced departure from first-order kinetics. Formation of vinylene unsaturation is accurately described by the equation $c - c_0 = (c_\infty - c_0)(1 - e^{-kD})$ which is based on a linear increase of concentration with dose followed by a first-order elimination, both effects being independent of vinyl unsaturation. The limiting concentration attained is greater, the greater the crystallinity of the polyethylene. At liquid nitrogen temperatures vinyl destruction is virtually suppressed, but vinylene formation is scarcely affected. Approximately half of hydrogen elimination results in vinylene formation, probably by molecular detachment because of its zero temperature coefficient. A post-irradiation heating of the polyethylene to room temperature causes a significant amount of vinyl or vinylidene destruction, thus proving the existence of free radical reactions in the solid state. Evidence from infrared data for cyclization or ring link formation is given. Production of ring links is linear with time, and the greater the crystallinity of the polyethylene. The yield of ring links is less at liquid nitrogen temperature than at room temperature. The first-order kinetics observed for vinyl, vinylidene and vinylene elimination together with the high initial value of G_0 for vinyl decay, 9.6, can only be explained on the basis of activation of the double bond by energy of excitation released in localized regions corresponding to the spurs of fast electron tracks. Thus this paper describes the kinetics of decay in the solid phase of a specific group whose chemical structure and concentration are both known. (auth)

9055

γ-RAY INITIATED REACTIONS. II. THE ADDITION OF SILICON HYDRIDES TO ALKENES. A. M. El-Abbady and Leigh C. Anderson (Univ. of Michigan, Ann Arbor). J. Am. Chem. Soc. 80, 1737-9(1958) Apr. 5.

Trichlorosilane and methyldichlorosilane add to the double bond of certain alkenes in the presence of γ rays as initiator. These compounds include octene-1, isobutylene, butene-2, 2-methyl-2-butene, cyclopentene, cyclohexene, 1-methylcyclohexene, allyl chloride, allyl acetate, allyl cyanide, cis-1,2-dichloroethylene, 3,3,4,4,4-pentafluoro-1-butene, 2-methyl-3,3,4,4,4-pentafluoro-1-butene, 3,3,4,4,5,5,5-heptafluoro-1-pentene and 2-methyl-3,3,4,4,5,5,5-heptafluoro-1-pentene. Ethyl cinnamate, diethyl fumarate, indene and trans-stilbene were unreactive. Styrene and α-methylstyrene gave high-boiling silicon polymers. In addition to the isolation of the saturated monomeric adducts, some high-boiling alkylsilyl substituted derivatives were also obtained. Some of the adducts obtained in this way were converted to their tetraalkylsilyl derivatives or hydrolyzed to form polysiloxanes. On hydrolysis 3,3,4,4,5,5,5-heptafluoro-1-pentyltrichlorosilane gave unexpectedly a liquid siloxane. (auth)

9056

THE EFFECT OF OXYGEN ON FERRIC ION YIELDS IN AQUEOUS SOLUTIONS CONTAINING POLONIUM. Conrad N. Trumbore (Univ. of Rochester, N. Y.). J. Am. Chem. Soc. 80, 1772(1958) Apr. 5.

A revised $G(Fe^{3+})$ yield of 5.2 ± 0.15 has been obtained for α particles from dissolved Po^{210} in the aerated Fricke ferrous sulfate dosimeter. The previous value of about 6.0 reported by various workers is probably too high. Other lower values have been reported recently. $G(Fe^{3+})$ has been found to vary from 3.7 ± 0.2 in air-free solutions to values approaching 10 at oxygen concentrations above 0.1 M. Solutions studied were 3 mM in $FeSO_4$, 1 mM in NaCl, 0.8 N in H_2SO_4, and contained on the average 0.4 mc/ml of Po^{210} $G(Fe^{3+})$ was made independent of dose rate between 0.01 and 0.90 mc/ml. (auth)

9057

A STUDY OF SZILARD-CHALMERS EFFECT ON BROMIDE COMPOUNDS. I. CHEMICAL FORMS OF RADIOACTIVE BROMINE OBTAINED THROUGH SZILARD-CHALMERS EFFECT ON POTASSIUM BROMATE. R. Henry, C. Aubertin, and de la Guéronnière (Service des Radioelements Artificiels, Commissariat a l'Energie Atomique). J. Phys. radium 18, 320-2(1957) May. (In French)

After a study of the changes in retention in potassium bromate that appear after irradiation at different fluxes, the reason for these changes was investigated. Radioactive bromine is partially oxidized (bromite or hypobromite). Changes in chemical behavior at different fluxes of irradiation are tentatively assigned to changes in the concentration of these recoil species. (tr-auth)

9058

RADIATION-INDUCED REACTIONS OF POTASSIUM BROMIDE WITH AIR. A. Russell Jones (Oak Ridge National Lab., Tenn.). Science 127, 234(1958) Jan. 31.

When a pressed potassium bromide disc was irradiated in ordinary laboratory air, new bands appeared in the infrared absorption spectrum, with maxima at 1360, 1260, 830, 1441, 1765, and 2340 K. Irradiation of a disc in an atmosphere of dry oxygen produced, in addition to the peak at 1440 K, an infrared absorption band with a maximum at 790 K. The possibility of the presence of potassium nitrate, potassium nitrite, potassium bromate, and carbon dioxide arising from the radiolysis of organic impurities is discussed. (C.H.)

9059

CHEMICAL BEHAVIOR OF HOT ATOMS IN NUCLEAR TRANSFORMATION. An. N. Nesmeyanov and E. A. Borisov. Uspekhi Khim. 28, 133-61(1958) Feb. (In Russian)

A review is given of the current data on the hot atom chemistry in organic systems. The behavior of the product atoms from slow neutron capture, the effects of the temperature and composition on the retention of the radioactive atom in (n,γ) reactions, and the relation of the mass and initial recoil energy of the particles on the retention in elastic collisions are discussed. (R.V.J.)

Radiation Effects

9060 NP-6685

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

MONTHLY ACCESSION LIST NO. 10 [ON RADIATION EFFECTS DATA]. Apr. 15, 1958. 12p. Project No. 2133. Contract AF33(616)-5171.

9061 REIC-4

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

THE EFFECT OF NUCLEAR RADIATION ON LUBRICANTS AND HYDRAULIC FLUIDS. S. L. Cosgrove. Apr. 30, 1958. 78p. Project No. 2133. Contract AF33(616)-5171. (AD-154432).

The state of the art of the effect of nuclear radiation on aircraft lubricants and hydraulic fluids from 1955 through

1957 is presented. A brief review of the mechanism by which organic materials degrade chemically under the influence of nuclear radiation is followed by a discussion of the radiation stability of current aircraft lubricants and hydraulic fluids. In general, military-specification aircraft lubricants and hydraulic fluids show inadequate radiation stability for projected ANP purposes. The incorporation of antirads into these materials does not provide the necessary additional stability. Aromatic compounds, specifically alkyl biphenyls, and substituted aromatic ethers, show the most promise as radiation-resistant base stocks. In most cases their performance properties have yet to be fully evaluated, especially under in-source, or dynamic irradiation, conditions. Lubricants are categorized by function; radiation-resistant lubricant and hydraulic-fluid development programs are reviewed by chemical species rather than by the contracting agency responsible for their development. The appendixes contain selected tabular data showing the effects of radiation on both conventional materials and those developed for projected ANP use. (auth)

9062

NITROGEN FIXATION BY IONIZING RADIATION. S. Ya. Pshezhetskiy and M. T. Dmitriyev. Atomnaya Energiya 3, No. 10, 350-2(1957).

The rules applying in the case of the oxidation of nitrogen under the influence of electron collisions and γ radiation were determined experimentally. A 2-kv electron tube, a 200 kv linear accelerator, and a 1400 c Co^{60} source were used as radiation source. The oxidation velocity dependence on radiation dose, gas composition, gas pressure, and gas temperature was especially investigated. For an electron impact up to 100 ev the process: $N_2 \rightarrow N_2^+ + e(N_2^{+*} + e, N_2^{++} + 2e)$ is about 10 times as probable as the process: $N_2 \rightarrow N^+ + N + e(N^+ + N^* + e, N^{+*} + N^* + e)$. The most important reactions observed are: $N_2^+ + O_2 \rightarrow NO^+ + NO$; $N_2^{+*} + O_2 \rightarrow NO_2^+ N$; $N + O_2 \rightarrow NO + O$; and $N + O_2 + M \rightarrow NO_2 + M$. Tabularly the reaction yields are given in molecules NO_2 per 100 ev for the various radiators at various values of pressure and temperature. (TCO)

9063

ACTION OF IONIZING RADIATIONS ON PROTEIN SOLUTIONS IN AIR AND IN VACUO. T. E. Pavlovskaya and A. G. Pasynsky (A. N. Bakh Inst. of Biochemistry, Academy of Sciences, USSR, Moscow). Biochemistry (U.S.S.R.) 22, 250-7(1957) Jan.-Apr.

Measurements were made of the turbidity and absorption by human serum albumin solutions in the ultraviolet region of the spectrum, upon irradiation with x rays in air and in vacuo in pure aqueous solutions and in the presence of cysteine and sodium caprylate. (auth)

9064

THE RADIATION INDUCED cis-trans ISOMERIZATION OF POLYBUTADIENE. I. Morton A. Golub (B. F. Goodrich Co. Research Center, Brecksville, Ohio). J. Am. Chem. Soc. 80, 1794-8(1958) Apr. 20.

The cis double bonds in a high cis-polybutadiene in solution are readily converted into trans double bonds on exposure to γ-rays in the presence of a suitable sensitizer such as an organic bromide. The isomerization proceeds in the direction of attaining an equilibrium cis/trans ratio of approximately 5/95. This reaction is analogous to the recently reported photosensitized cis-trans isomerization of polybutadiene. In addition, a very much slower "unsensitized" radiation induced isomerization of the double bonds was also observed in solution. However, no change in cis/trans ratio could be obtained on γ-irradiation of the solid polymer. The kinetics of the isomerization of polybutadiene in benzene were studied using allyl bromide, ethyl bromide and ethylene bromide as sensitizers, and found to be first order with respect to the cis content in the polymer and somewhat less than half-order in organic bromide. The mechanism is considered to involve π complexing between the double bonds and free bromine atoms formed in the radiolysis of the bromide. An interesting application of this isomerization is its possible use as a dosimeter in radiation chemistry. (auth)

Rare Earths and Rare-earth Compounds

9065 AEC-tr-3208

INTERACTION BETWEEN CERIUM AND HYDROGEN. V. I. Miheyev and M. E. Kost. Translated by Lydia Venters from Doklady Akad. Nauk S.S.S.R. 115, 100-2 (1957). 6p.

The hydrogenation of metallic cerium can be achieved at room temperature without using a preliminary heat treatment of the cerium samples, if the initial substances are carefully purified. The hydrogen absorption of cerium at room temperature (14 to 21°) results in the formation of hydride with chemical composition $CeH_2 - CeH_{2.16}$, and this reaction does not depend on hydrogen pressure. The variation curves of the composition of hydride and the temperature and the curves of the hydrogenation rate confirm the formation of specific hydrides CeH_2 and CeH_3 and the pressure of a phase of changeable composition between CeH_2 and $CeH_{2.16}$. (auth)

9066 AEC-tr-3222

DETERMINATION OF THE HEAT OF TRANSITION IN CERIUM UNDER PRESSURE. M. G. Gonikberg, G. P. Shakhovskoi, and V. P. Butuzov. Translated from Zhur. Fiz. Khim. 31, 350-3(1957). 7p.

The heat of transition of cerium was determined as 880 ± 40 cal/g-atom at temperatures of 13 to 18°C and a pressure of about 7000 kg/cm^2. The study confirms the identity of the cerium modification which occurs under high pressure with its low temperature modification. (J.S.R.)

Separation Procedures

9067 AERE-C/M-233

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SEPARATION BY CATION EXCHANGE OF SMALL QUANTITIES OF CALCIUM FROM THE PRODUCTS OF ITS NEUTRON IRRADIATION. M. J. Cabell. Dec. 29, 1954. Decl. Sept. 12, 1957. 8p.

A cation exchange method is described for separating pile-irradiated calcium from the tracer scandium and active impurities produced in it. The calcium is taken up on a 4.5 cm column containing 0.25 g of 50 μ particle size Zeokarb 225 and several fractions are taken by elution with hydrochloric acid eluents of different strengths. (auth)

9068 DOW-78

Dow Chemical Co. Western Div., Pittsburg, Calif.

THE RECOVERY OF URANIUM FROM DAVISON LEACH LIQUOR. R. R. Grinstead. June 9, 1952. Decl. Apr. 21, 1958. 47p. Contract AT-30-1-GEN-236. $7.80(ph OTS); $3.30(mf OTS).

An investigation of the recovery of uranium from a dilute H_2SO_4 leach of certain gypsum residues from the phosphate industry is described. The most attractive recovery method appears to be an anion-exchange process involving adsorption of uranium on a resin, elution with a 0.9 M NaCl + 0.1 M HCl solution, and precipitation of the eluted uranium with a base. One volume of resin is

capable of treating more than 300 volumes of liquor, giving loadings of about 2 lbs. U_3O_8/cu. ft. resin. A direct precipitation method was also investigated. This method involves reduction of ferric iron and uranium with metallic iron and sodium hydrosulfite in the presence of sodium pyrophosphate. A recovery of 93% of the uranium as a 45% U_3O_8 product was made. Experiments on uranium recovery by liquid-liquid extraction with alkyl phosphates and adsorption on phosphorylated cotton are also reported. (auth)

9069 HEC-89

Hooker Electrochemical Co., Niagara Falls, N. Y.

STUDY AND IMPROVEMENT OF ELECTROLYTIC BORON PROCESS. George T. Miller. May 7, 1958. 31p. Contract AT-(30-1)-1524. $6.30(ph OTS); $3.00(mf OTS).

Study and improvement of the fused-salt electrolytic production of elemental boron were concerned with the reclamation of boron values from spent electrolyte; decrease in loss of boron values by volatilization; decreased use of hydrogen; cell design modification; cathode design; temperature study and control; effect of current density; effect of impurities and additives to the electrolyte (including K, Al, Ca, SO_4^{-2}, H_2O, Ni, V and Inconel); and anode material of construction. A tabulation of unfinished and proposed research work is included. (auth)

9070 NP-6684

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

PRELIMINARY STUDIES ON CHLORINATION OF NATIVE URANIUM ORES. Report No. 13/IV. T. Adamski, W. Dembinski, and S. Domanus. Feb. 1958. 9p.

The results of investigations on chlorination of one of the native uranium ores are presented. These were preliminary experiments initiating more extensive research work concerned with the mechanism and usefulness of extracting uranium from native ores with the aid of gaseous chlorine. The preliminary experiments were designed to afford general information on possibilities of complete extraction of uranium from the ore and selective conducting of the process. (auth)

9071 ORNL-2486

Oak Ridge National Lab., Tenn.

PROGRESS REPORT ON RAW MATERIALS FOR DECEMBER 1957. Chemical Technology Div. K. B. Brown. May 2, 1958. 31p. Contract W-7405-eng-26. $1.00(OTS).

Systematic Studies. In extraction of uranyl sulfate by kerosene solutions of N-benzylheptadecylamine (NBHA) from 1 M sulfate at pH 1, the extraction coefficient varied with a power between 1 and 1.5, and in extraction from 3 M sulfuric acid solution with the first power of the uncomplexed amine concentration. Extraction decreased with increasing sulfate concentration, but extraction coefficients were still high (>300 with 0.1 M NBHA) from 4 M $(NH_4)_2SO_4$–H_2SO_4 solutions when the H_2SO_4 content was 0.5 M or less, dropping to ~1 at 3 M. With 4 M H_2SO_4 the amine solutions separated into two phases. In continued tests of strontium-sodium exchange between di(2-ethylhexyl)phosphate and aqueous solutions, the strontium extraction enhancement at pH ~5 over that at higher or lower pH's previously reported from nitrate solutions was also found from acetate solutions. An extraction isotherm from acetate buffer solution was consistent with the previously postulated complex formation, and showed that the enhancement is not limited to trace strontium. Tracer cesium extractions confirmed the preferential extraction of sodium over cesium by D2EHP from nitrate solution at pH 4 to 11. Process Development. In a continuous Amex run demonstrating the ammonium nitrate stripping flowsheet, >99.9% of the uranium and ~96% of the molybdenum were recovered from a synthetic leach liquor containing 3.5 g of uranium and 0.12 g of molybdenum per liter. Stripping of uranium was 99.9% complete, yielding a strip solution containing 30 g of uranium and 0.1 g of molybdenum per liter. Consumption of nitrate was 0.25 lb/lb of U_3O_8. Molybdenum, which tended to accumulate in the regeneration system, was sorbed from the uranium-barren ammonium nitrate solution (produced by regenerating the amine with ammonium hydroxide) on an ion exchange resin column; it was eluted with dilute caustic with difficulty. Control and physical operation of the regeneration system was satisfactory, although high entrainment of ammonium nitrate solution in the organic recycle stream is a potential process problem. Molybdenum was recovered effectively from Amex nitrate strip solutions by adsorption on activated carbon, which was still far from saturation at a molybdenum loading of 220 g/kg of carbon. The molybdenum was readily eluted with dilute ammonium hydroxide, using 0.4 lb NH_3 per pound of molybdenum. Evaporation of the eluate and calcination gave a molybdenum product containing >99.9% MoO_3. The rate of phase separation of amine solutions when contacted with leach liquors containing dissolved silica was dependent on a number of variables, including silica concentration, amine-diluent choice, amine concentration, liquor pH, temperature, and the type of mixing. When mixing was with the organic as the continuous phase, separation times were not appreciably affected by silica, but with aqueous-continuous mixing, separations slowed with increase in silica concentration, the effect being much more pronounced for some amine-diluent combinations than for others. Of the amines tested, ditridecyl amine was affected least by the presence of silica. With 9D-178 amine (aqueous-continuous mixing), separation times decreased markedly with increase in temperature or decrease in solution pH but were not greatly affected by change in amine concentration in the range 0.0 to 0.1 M. Engineering Studies. Phase separation in the extraction step of the Amex process (0.1 M Rohm and Haas Amberlite LA-1 in kerosene) was evaluated in 6- and 48-in.-diam- gravity settlers. The flow capacity based on cross-sectional areas was the same for both sizes, demonstrating the feasibility of simple scaleup. The nominal aqueous flow capacity for oil-in-water type dispersions was 0.8 gpm/ft^2 at a phase ratio of 1/1 and 2.9 gpm/ft^2 at 4/1. For water-in-oil type dispersions the aqueous flow capacity was 0.4 gpm/sq ft at at. % phase ratio of 1/1 and 1/2. Modification of the kerosene diluent with 3% tridecanol increased the flow capacity for water-in-oil type dispersions from 0.4 to 0.7 gpm/ft^2. No change was noted for oil-in-water type dispersions. Entrainment of solvent in the aqueous phase after the primary break was low (0.04 to 0.1 gal/1000 gal) for water-in-oil type dispersions. For oil-in-water type dispersions the entrainment was 0.04 to 0.3 gal/1000 gal at an aqueous/organic phase ratio of 1/1 and was 1.0 to 3.0 at a ratio of 4/1. In scouting tests to find methods of increasing the rate of phase separation dispersions were effectively coalesced by glass filter cloth, wire cloth, or application of an electrical potential. Fundamental Studies. Isopiestic measurements of the concentration of solute particles in the di(2-ethylhexyl)phosphoric acid—tri-n-octylphosphine oxide—n-octane system gave qualitative corroboration of adduct formation as previously reported on the basis of spectrophotometric data. The method appears suitable for quantitative testing of the formation constants previously derived. (For preceding period see ORNL-2466.) (auth)

9072 ORNL-2512

Oak Ridge National Lab., Tenn.

SEPARATION OF FLUORIDE FROM REFRACTORY MA-

TERIALS BY FUSION-PYROLYSIS. R. H. Powell and O. Menis. May 12, 1958. 16p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

A pyrolytic method was developed for the separation of fluoride from clays and related refractory materials which is much simpler and less time consuming than classical methods previously used for this purpose. A sample which, preferably, contains 0.01 to 25 mg of fluoride is intimately mixed with a flux, sodium tungstate (Na_2WO_4), and a compatible accelerator, tungstic oxide (WO_3), and pyrolyzed at 825°C in a stream of moist oxygen for 1.5 hr. The fluoride is volatilized, absorbed in dilute sodium hydroxide, and subsequently determined by acidimetric or spectrophotometric titrimetry. A detailed procedure is given, several variables which were evaluated in establishing optimum operational conditions are discussed, and test results obtained by applying this method to the analysis of standard opal glass and phosphate rock samples from the National Bureau of Standards are compared with the certified values for fluoride. In these instances the coefficient of variation is less than 0.5%. The pyrolytic method was utilized to analyze light clay and clay-like samples which contained from 0.1 to 12 mg of fluoride per gram. The coefficient of variation was found to be 8%. (auth)

9073 USNRDL-TR-218

Naval Radiological Defense Lab., San Francisco.

LABORATORY STUDIES ON THE DECONTAMINATION OF RADIOACTIVE SEAWATER BY COAGULATION AND SEDIMENTATION. M. Honma and A. E. Greendale. Mar. 31, 1958. 20p.

The radioactive decontamination of sea water until now has been difficult because of its salinity and therefore its high ionic strength. However, this salinity makes sea water conducive to the attempted removal of radioactive materials through flocculation techniques. A survey of candidate decontaminating materials has been conducted, out of which the more promising decontaminants were examined further for their efficiency in the removal of mixed fission products in sea water. Approximately 85 to 95% decontamination is achieved in a single-stage stirring process by clays, phosphates, silicates, and iron salts used singly or in binary combinations. Other studies using selected radioisotopes ordinarily found in mixed fission products have given similar results except for iodine and cesium. Only 14% of iodine-131 and negligible amounts of cesium-137 were adsorbed by the flocs. Generally speaking, sodium ortho silicate turned out to be the best singular decontaminant. More extensive investigations of the various sodium silicates in controlled hydrogen ion concentrations, floc weights, and Na_2O/SiO_2 ratio studies have shown that the more alkaline silicates are superior to the siliceous silicates in their removal characteristics. Moreover, the efficiency of mixed fission products decontamination from sea water is directly proportional to the floc volume. (auth)

9074 WIN-91

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

AMENABILITY TESTING OF LaBAJADA ORE. R. U. Johnson. Apr. 17, 1958. 15p. Contract AT(49-6)-924. $3.30(ph OTS); $2.40(mf OTS).

Data are presented on the results of acid and carbonate leaching studies on samples of ore from the LaBajada Mine of the Lone Star Mining Company, Santa Fe County, New Mexico. (auth)

9075 WIN-106

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

ALKALINE LEACH–FILTRATION PILOT PLANT TESTING OF MONTICELLO BLEND OF HIGH LIME ORES. Howard E. Dixon and Guy Winslow. Mar. 14, 1958. 32p. Contract AT(49-6)-924. $6.30(ph OTS); $3.00(mf OTS).

A blend of LaSal, Standard, and Jen ores from the Monticello stockpiles was treated in the Alkaline Leach–Filtration Pilot Plant at Grand Junction, Colorado. This report contains detailed information on grinding, leaching, filtration, and precipitation in connection with the processing of this ore. Autoclave leaching and continuous NaOH precipitation were employed. The results show the ore to be amenable to the Alkaline Leach–Filtration process. (auth)

9076

THE DISTRIBUTION OF PLUTONIUM AND OF THE FISSION PRODUCTS IN A MIXTURE OF MOLTEN URANIUM AND UF_3–$BaCl_2(F_3)$. V. P. (P. V.). Atomnaya Energiya 3, No. 8, 175(1957).

At a temperature of 1200 to 1400°C plutonium and fission products are extracted from irradiated uranium on the basis of transition from the metal to the salt phase. It is necessary to wait at least 1 hour before equilibrium is established. For the extraction of plutonium the equilibrium constant is given. The fission products are separated up to 99%. Determination of the equilibrium constant was not possible because of the disturbing influence of the process of oxidation. (TCO)

9077

EXTRACTION OF CHLORIDES FROM HYDROCHLORIC ACID SOLUTIONS WITH TRIBUTYL PHOSPHATE. Ivan J. Gal and Aleksandar Ruvarac. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 67-74(1958) Mar.

The partition of the chlorides of H^+, Fe^{3+}, Fe^{2+}, UO_2^{2+}, Cd^{2+}, Ni^{2+}, Co^{2+}, Sr^{2+}, Zr^{4+}, Ce^{3+}, RuO^{2+} (possibly a mixture of tri- and tetravalent ruthenium) as well as of VO_3^- between 30% (v/v) tributyl phosphate in dibutyl ether and aqueous solutions of different HCl concentration was determined. The dependence of the extraction on the TBP concentration in the organic phase for some of these elements was also investigated. Possibilities of mutual separations are discussed and formulas for some of the complexes extracted are proposed. (auth)

9078

THE IMPORTANCE OF SOLVENT EXTRACTION IN ATOMIC ENERGY. E. Glueckauf (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Ind. chim. belge 23, 227-32(1958) Mar.

The large-scale utilization of solvent extraction for the purification and isolation of inorganic materials in atomic industry is surveyed. The separation of U and Pu and their fission products, of Th and U and their fission products, of Hf and Zr, of Nb and Ta, and of the rare earths and protactinium are discussed. (J.S.R.)

9079

SCALE-UP PROBLEMS IN THE PLUTONIUM SEPARATIONS PROGRAM. O. F. Hill and V. R. Cooper (General Electric Co., Richland, Wash.). Ind. Eng. Chem. 50, 599-602(1958) Apr.

Early during World War II, a major problem in developing an atomic bomb was separating plutonium on a commercial scale. Most of the processes conceived today were in some measure under study then, and this article describes the solution to some engineering problems encountered. The precipitation method was selected for development and, because of the time factor, process and plant design had to proceed simultaneously. Ultramicro scale and laboratory beaker experiments were extrapolated to full scale plant. Pilot plant data by supplying mechanical data contributed substantially to early successful operation of the plant. This early development program showed that

radio-chemical processes can be scaled up from laboratory data with good confidence. (auth)

9080

ION EXCHANGE SEPARATION OF URANIUM FROM THORIUM. R. H. Poirier, G. D. Calkins, G. A. Lutz, and A. E. Bearse (Battelle Memorial Inst., Columbus, Ohio). Ind. Eng. Chem. 50, 613-16(1958) Apr.

Uranium has been separated and concentrated from sodium carbonate solutions of monazite sand residues using strong base ion-exchange resins, particularly amberlite IRA-400. The uranyl tricarbonate anion, $[UO_2(CO_3)_3]^{-4}$, is believed to be the active species in this exchange. The interference of anions present in monazite process solutions on the exchangeability of the uranyl carbonate complex was evaluated, and exchange data were obtained on a solution prepared from a typical sample of concentrates of Brazilian sand. The use of strong base exchangers in carbonate systems as a means of exhaustive removal of uranium from thorium is indicated. (auth)

9081

EXTRACTION OF URANIUM FROM PHOSPHATES BY SOLVENT EXTRACTION. R. S. Long, D. A. Ellis, and R. G. Beyls. Khim. yadernogo goryuchego, 7-16(1956). (Translated from Referat. Zhur. Khim. No. 3, 1957, abstract no. 8763).

The authors discuss the flow sheet for the extraction of U from commercial phosphoric acid (obtained by the treatment of Florida phosphate ores with H_2SO_4). The extraction is carried out by treating an H_3PO_4 solution (1,000 liters commercial H_3PO_4 containing 30% P_2O_5 and 115 gms U_3O_8) with a 1 to 2% solution of alkylpyrophosphate in kerosene, followed by separation of the phases, extraction of the U from the solution as the fluoride by precipitation with 48% HF (the final yield is 109 gms on a U_3O_8 basis), and recycling of the solvent with the addition of fresh solvent make-up. A process permitting the 80% extraction of U from superphosphate is also discussed. The process consists of the following steps: (1) addition of HNO_3 (2.7 kg per ton of ore), the acid initially going into the formation of superphosphate; (2) extraction of U from the superphosphate after "aging" by percolation leaching with a 1 to 2% solution of octylpropionic acid in hexane, using a 1:1 wash-to-ore ratio; (3) washing with hexane to remove the octylpyrophosphoric acid absorbed by the precipitate; (4) distillation of the hexane by heating the precipitate to $\leq 80°$; and (5) extraction of U from the octylpyrophosphoric acid solution.

9082

CARBONATE LEACHING OF URANIUM ORES. F. M. Stevens, Jr. and R. D. MacDonald. Khim. yadernogo goryuchego, 40-58(1956). (Translated from Referat. Zhur. Khim. No. 3, 1957, abstract no. 8761).

A survey is presented on the carbonate leaching of uranium ores. At the present time three modifications of the carbonate leaching process are in use in the USA. Preliminary oxidation of the uranium ores is practiced in all three processes. (1) Carnotite-type ores containing a large amount of V are first roasted with NaCl at 600 to 850°, followed by leaching with hot soda ash solutions (AEC Monticello Plant, Utah); (2) the raw ore is treated with aqueous solutions of Na_2CO_3 and $NaHCO_3$ at atmospheric pressures (Anaconda Copper Mining Company Plant, Grant, New Mexico); and (3) the raw, partially oxidized or primary ore (uranium-gearing pitchblende, uraninite) is treated with aqueous Na_2CO_3 or $NaHCO_3$ at elevated temperatures in the presence of an oxidizing substance ($KMnO_4$ and atmospheric oxygen) (Hydrometallurgical Plant of Colorado Mining and Refining, Ltd., Beaver Lodge, Canada). The flow sheets for the processes used at the different plants are discussed. The bibliography lists nine items.

9083

EXTRACTION OF URANIUM FROM ORES. G. Mervin. T. Upchurch, E. Greenleaf, E. Blarkom, and A. Murphy. Khim. yadernogo goryuchego, 91-101(1956). (Translated from Referat. Zhur. Khim. No. 3, 1957, abstract no. 8760).

A survey on the extraction of uranium from its ores is presented. The primary ores are decomposed with concentrated acids; the secondary ores are treated with alkali (including Na_2CO_3, $NaHCO_3$, $(NH_4)_2CO_3$). The choice of disintegration method depends on the composition of the ore. An increase in the contact time, temperature (20 to 90°), and in the grain size (from 10 to 20 mesh) in the acid-leach process leads to a gradual increase in the percent extraction of U. The addition of oxidizing substances increases the yield of U; the utilization of MnO_2 in amounts of 5 kg per ton of ore has proven most economical. The effect of the above-enumerated factors is the same in the alkaline-leach method. The precipitation and filtration of muddy residues causes some difficulty in the treatment of the ores. New chemical flocculation agents have been developed to improve the settling of the cake after leaching. The separation of U from the cake and from the solutions is carried out by one of the following methods: chemical precipitation, used in the treatment of ores which give easily filterable solutions (mainly by precipitation with alkali from bicarbonate solutions); fixed bed ion exchange (for the extraction of U from clarified sulfuric acid solutions); moving-bed ion exchange; and organic extraction (extraction of U from phosphoric acid solutions).

9084

ACID LEACHING OF URANIUM ORES UNDER PRESSURE. P. M. Grey. Khim. yadernogo goryuchego, 102-11(1956). (Translated from Referat. Zhur. Khim. No. 3, 1957, abstract no. 8762).

Methods are discussed permitting the realization of savings in the reagents (H_2SO_4 and oxidizers) used in the acid leaching of uranium ores. The leaching of davidite concentrate and ores containing uranite, associated with Fe and Cu sulfides as well as siliceous shists, is described. The leaching of davidite concentrate at 150° and at an operating pressure of ~7 atms permits a threefold reduction in the consumption of H_2SO_4 (compared to that required for leaching at atmospheric pressure), reduces the time required for the operation, and reduces the concentration of TiO_2 and Fe_2O_3 in the solution (< 0.05 gms/liter and ~3 gms/liter instead of 1 gm/liter and > 50 gms/liter, respectively). In the treatment of sulfide ores under pressure, H_2SO_4 is formed and separated from the ore. Increasing the partial pressure of O_2, the temperature, and the leaching time results in an increase in the extraction of U_3O_8. The process proceeds considerably faster than at atmospheric pressure, the leaching is more selective, and the ore does not have to be ground to as fine a grain size (only 60% of the ore has to be reduced 2 to 200 mesh). The highest extraction of U (95%) is attained when a temperature of 140° and a contact time of two hours are used or when a temperature of 180 to 200° and a contact time of one hour are used; the partial pressure of O_2 is 2.8 to 3.2 atms.

9085

A SURVEY OF SEPARATION PROCESSES. S. Lavrosky. Khim. yadernogo goryuchego, 153-73(1956). (Translated from Referat. Zhur. Khim. No. 3, 1957, abstract no. 8765).

A survey is made of the basic methods used in the regeneration of nuclear fuels permitting their complete utilization. The following reprocessing and purification methods are discussed: precipitation, ion exchange, frac-

tional distillation, and pyrometallurgical processes. 12 references.

9086

REPROCESSING OF REACTOR FUEL ELEMENTS AND CLADDING MATERIALS BY SOLVENT EXTRACTION. F. L. Culler. Khim. yadernogo goryuchego, 258-308(1956). (Translated from Referat. Zhur. Khim. No. 3, 1957, abstract no. 8766).

The following questions are discussed: (1) nuclear fuels and the requirements of the regeneration process; among the topics covered are the types of nuclear fuels used and flow sheets for the chemical treatment processes, the cooling periods required for the decomposition of the radioactive contaminants, the contamination by the fission products, and the purification of the fissionable material and of the material to be used in the preparation of secondary nuclear fuels from the daughter products formed during neutron irradiation; (2) the technical processing of the fuel elements, with flow sheets describing the recovery of the fissionable materials and the materials used in the preparation of secondary fuel elements by solvent extraction; (3) auxiliary processes: solvent regeneration, iodine removal, and separation of fissionable materials; and (4) equipment used in the solvent extraction process. General information of value to those designing equipment for radiochemical processes and waste removal is also discussed. 23 references.

9087

SEPARATION OF HAFNIUM FROM ZIRCONIUM BY THE SELECTIVE OXIDATION OF ZIRCONIUM IN MIXED CHLORIDE VAPORS. B. Prakash and S. V. Sundarem. Khim. yadernogo goryuchego, 523-32(1956). (Translated from Referat. Zhur. Khim. No. 3, 1957, abstract no. 8767).

Thermodynamic calculations have been made for the reactions $ZrCl_{4(gas)} + O_2 \rightleftharpoons ZrO_2 + 2Cl_2$ (1) and $HfCl_{4(gas)} + O_2 \rightleftharpoons HfO_2 + 2Cl_2$ (2) in the temperature range 500 to 1200°. At 1,000°, the ΔF and K_p for reaction (1) are $-30{,}900$ and 2.02×10^5, respectively, ($P_{Cl_2}/P_{O_2} = 4.5 \times 10^2$); for reaction (2) the corresponding values are 52,540, 9.55×10^{-10}, and 3.09×10^{-5}, respectively. Thus the possibility of separating ZrO_2 by the selective oxidation of a mixture of $ZrCl_4$ and $HfCl_4$ in the presence of Cl_2 and O_2 has been established. In the experimental setup the chloride is obtained by the chlorination of zirconium carbide at 500°. The product, in addition to Hf, contains the following (in percent): Si, 0.1; Ti, 0.06; and Fe, 0.18. Si and Ti are separated by fractional distillation. The chloride containing 0.01% Si, 0.002% Ti, and 2.54% HfO_2 (on the basis of $ZrO_2 + HfO_2$) is distilled in a stream of dry Cl_2 and passed into a furnace where it is reacted with Cl_2 and O_2. At a $Cl_2 : O_2$ ratio of 1.2, a temperature of 800°, and a contact time of one hour, the precipitate contains 1.4% Hf and the volatile products, 25% Hf. The yield of ZrO_2 is 90 to 97%. Similar results were obtained with a wide range of temperatures and pressure ratios. 20 references.

9088

METHODS FOR THE SEPARATION OF HAFNIUM FROM ZIRCONIUM AND THEIR INDUSTRIAL APPLICATION. F. Hadswell and J. M. Hatchen. Khim. yadernogo goryuchego, 533-50(1956). (Translated from Referat. Zhur. Khim. No. 3, 1957, abstract no. 8768).

The following methods are discussed: fractional distillation of complexes formed by zirconium and hafnium tetrachlorides with $POCl_3$; fractional distillation of the alcoholates; separation by paper chromatography; cation exchange; extraction from solution with tributyl phosphate; and methods for the separation of Hf during the extraction of metallic Zr from ores. It is noted that the above-enumerated methods are better suited for application to ores treated with NaOH than to the carbide process which is currently used. These methods should find greater application in the event that the Kroll process is abandoned for any reason. 13 references.

9089

CHEMICAL PROCESSING FOR NUCLEAR ENERGY. ITS PROBLEMS AND IMPORTANCE. D. A. Collins and J. S. Nairn (United Kingdom Atomic Energy Authority, Sellafield, Cumb., Eng.). Nuclear Eng. 3, 191-7(1958) May.

Improvements in fuel element economy lead to more chemically intractable fuel in even more intractable canning. All this leads to more complex chemical separation problems associated with spent fuel reprocessing. In assessing the economic gain from changes, either in the type of fuel or the type of chemical reprocessing, it is necessary to consider the significance of the change in each stage of the fuel cycle: initial fabrication of the fuel element, irradiation in reactor, chemical processing, re-enrichment, and refabrication of fuel element. Economic reprocessing demands a high use factor of the facilities, employing a large-scale power reactor system and adequate standardization of fuels. (W.D.M.)

9090

THE EXTRACTION OF NITRATES BY TRI-n-BUTYL PHOSPHATE (TBP). PART 3. EXTRACTION AT TRACE CONCENTRATIONS. E. Hesford and H. A. C. McKay (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Faraday Soc. 54, 573-86(1958) Apr.

Metal nitrates apparently exist in TBP predominantly in a single molecular form $M(NO_3)_p \cdot qTBP$. A theory of TBP extractions has been developed, based on this observation, and has been applied to experiments of three main types: (1) The TBP concentration is varied by adding an inert diluent. The results enable us to determine the solvation number q. (2) The nitric acid concentration is varied. In certain cases the measured partition coefficients then enable us to calculate the thermodynamic equilibrium constant and the activity coefficient of a trace of the extractable nitrate in a nitric acid medium. Reasonable functions are obtained for the latter quantity. (3) An inextractable nitrate, e.g. sodium nitrate, is added as a salting-out agent. Our theory enables us to estimate the resulting rise in partition coefficient. Separation factors (partition coefficient ratios) for pairs of similar elements have also been considered. (auth)

9091

RECOVERY OF Os^{191} AND Os^{193} OF EXTREMELY HIGH SPECIFIC ACTIVITY. W. Herr and R. Dreyer (Max Planck Inst. of Chemistry, Mainz). Z. anorg. u allgem. Chem. 293, 1-4(1957) Dec.

A technique was developed for the recovery of the highly radioactive isotopes of osmium in a carrier-free condition from inactive osmium samples which had been exposed to prolonged neutron irradiation. Prolonged standing before chemical treatment does not appreciably diminish the yield of the osmium isotopes, but heating of the irradiated samples reduces the chemical yield considerably. (J.S.R.)

9092

REACTOR FUEL PROCESSING. Technical Progress Review, Vol. 1, No. 2. Lemont, Argonne National Laboratory, 1958. 39p. Available from U. S. Government Printing Office, Washington for $0.55.

Commercial Aspects of Fuel Processing. The present relation of industry and the AEC in the field of reactor fuel reprocessing is discussed. A schedule of guaranteed prices for U^{233} and U^{235} is quoted. Fuel Processing Research and Development. Proposed modifications to the Purex and Redox Processes to permit recovery of Np^{237} are being

considered and tested. A two-cycle co-decontamination flowsheet has been developed for the Thorex Process, which offers better fission product decontamination and processing, particularly in the processing of short-decayed material. Two studies of the radiolysis of TBP systems are reported. Testing of various organic nitrogen compounds (alkylamines) and organic phosphoric acids is continuing at various sites for application to purification and recovery of nuclear metals. A new facility for the production of Ba^{140} has recently been placed in operation at the Idaho Chemical Processing Plant to supplant a facility operated at ORNL from 1945 to 1956. A single spent Materials Testing Reactor fuel assembly constitutes the charge material for each run, in which 25,000-curie batches of Ba^{140} are produced. A major problem in nearly all solvent-extraction processes is the achievement of adequate separation from Ru, Zr, and Nb. In laboratory studies it was found that 90 to 99% of both Zr and Nb could be removed from hot dissolver solution by MnO_2 formed in situ by the reduction of $KMnO_4$ and to a lesser extent Ru and Ce were also removed. The feasibility of obtaining complete fission-product decontamination of Plutonium Recycle Reactor fuels by anion exchange was tested in a two-cycle run. The fused-salt and bromine trifluoride Volatility Processes for the direct production of UF_6 are discussed. The dissolution rates of zirconium and stainless steel in fused salts along with volatilization of UF_6 from fused salts and volatilization and absorption of fission products from fused salts are described. The melt refining process will be used for the rapid purification and recovery of discharged EBR-II fuel. In the Hexmex Process the removal of fission products from irradiated U is described. In the Pyrozinc Process the solubility of Pu and U in zinc at 1000°K along with the distribution of activity in product phases is presented. The corrosion of process equipment in various aqueous head end processes is described. Waste Disposal. High-level liquid waste handling data for Hanford, Savannah River, and the National Reactor Testing Station are given. The conversion of liquid wastes to solids is discussed. Removal of specific fission products, iodine, and cesium is described. Conversion to Final Product Operations. The two methods under development for the production of UF_4 are described. The continuous production of UF_4 along with the conversion of $Th(NO_3)_4$ to ThO_2, recovery of UF_6 from vent gases, and production of Th metal by sodium amalgam reduction are described. (W.L.H.)

Sorption Phenomena

9093

EFFECT OF NUCLEAR POLARIZATION IN LIQUIDS AND GASES ADSORBED ON CARBON. Edmond Erb, Jean-Loup Motchane, and Jean Uebersfeld. Compt. rend. 246, 2121-3 (1958) Apr. 9. (In French)

The characteristics of an effect of nuclear polarization which has been observed in benzene liquid and gas adsorbed on carbon were defined. A phenomenological equation is proposed for the phenomenon. (tr-auth)

9094

THE TWO-DIMENSIONAL VAN DER WAALS CONSTANTS OF MOLECULES ADSORBED ON CHARCOAL AND GRAPHITE. J. H. de Boer and S. Kruyer (Central Lab., Staatsmijnen in Limburg, Netherlands). Trans. Faraday Soc. 54, 540-7(1958) Apr.

Entropy data indicate that physically adsorbed molecules of many gases on charcoal or on graphite are mobile and freely rotating. This picture is in accordance with other data and it induced us to apply a two-dimensional van der Waals equation to the adsorption data. It is then found that the adsorbed molecules repel each other. Explaining this repulsion by the repulsion of dipoles, induced in the adsorbed molecules by the surface, we obtain dipole moments which are in accordance with data, found by Mignolet in similar cases. The picture of induced dipoles leads to an appreciable contribution towards the heat of adsorption. (auth)

Syntheses

9095

S-ADENOSYLMETHIONINE AND ERGOSTEROL SYNTHESIS. L. W. Parks (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 80, 2023-4(1958) Apr. 20.

The side chain C-28 methyl group of ergosterol has been shown to arise intact from methionine, demonstrating that a carbon atom may act as the acceptor of a methyl group. A study was conducted of transmethylation in an ergosterol synthesizing system to determine the importance of the sulfonium derivatives. (J.R.D.)

Transuranic Elements and Compounds

9096

SOME PROPERTIES OF METALLIC NEPTUNIUM. G. Z. (Z. G.). Atomnaya Energiya 3, No. 8, 176(1957).

Investigations were carried out on a neptunium metal fragment originating from a bomb. Composition of admixtures (in %) were Ca, 0.34; U, 0.22; Ni, 0.06; Mg, 0.03; Cr, 0.03; Pu, 0.03; Al, 0.02; Mo, 0.05; V, 0.06. Np has a constant rhombic α phase at room temperature. Density at 20°C is 20.2 g/cm^3. Thermal capacity is 0.0319 cal/g°C between 29 and 99°C. Determination of hardness according to Meier resulted in the relation: stress in kg = 360 × (diameter in mm)$^{2.19}$, and according to Vikers the value obtained was 355. The tensile strength is between 124 and 138 kg/mm^2. (TCO)

9097

SPECTROSCOPIC STUDIES OF Pu^{+3} COMPLEX FORMATION AND STABILITY. A. D. Gel'man and A. I. Moskin. Atomnaya Energiya 3, No. 10, 314-16(1957).

The complex formation of Pu^{3+} with $C_2O_4^{2-}$, $C_2O_3^{2-}$, and $C_6H_5O_7^{3-}$ ions as well as with trylon B is proved by means of the spectrograph. The absorption spectra were measured, and their characteristic maxima were found at the following wave lengths: 565, 605, 665, 780 to 790, 905 to 910, 1090 mμ. (TCO)

9098

KINETICS OF THE NEPTUNIUM(III)–NEPTUNIUM(V) REACTION IN PERCHLORATE SOLUTION. J. C. Hindman, J. C. Sullivan, and Donald Cohen (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 80, 1812-14(1958) Apr. 20.

The kinetics of the Np(III)–Np(V) reaction is perchlorate solution have been investigated. The rate law for the forward reaction can be written as $-\partial[NpO_2^+]/\partial t = k_1[Np^{+3}][NpO_2^+][H^+]$. At 25° and $\mu = 2.0$, $k_1 = 2590$ l.^{2} mole^{-2} min^{-1}. The rate is slightly decreased in a deuterated medium. The experimental activation energy is 6.5 ± 0.5 kcal in $HClO_4$ solution and 5.6 ± 0.5 kcal in $DClO_4$ solution. Possible mechanisms for the reaction are considered. (auth)

9099

A HISTORY OF THE EARLY BRITISH WORK ON PLUTONIUM METALLURGY. J. G. Ball (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and W. B. H. Lord (Atomic Weapons Research Establishment,

Aldermaston, Berks, Eng.). J. Inst. Metals 86, 369-79 (1958) Apr.

Two teams worked at the Atomic Energy Research Establishment and the Atomic Weapons Research Establishment on programs of physical and process metallurgy intended to furnish empirical solutions to short-term problems, and to start on the accumulation of basic scientific data on plutonium metallurgy. The experiments included the use of dilatometry and thermal analysis to investigate the allotropy and alloying behavior of the metal, with other work on casting, forging, and extrusion, electrical resistivity, magnetic susceptibility, and the determination of crystal structures. (auth)

9100

SOME INVESTIGATIONS ON PLUTONIUM METAL. E. Dempsey and A. E. Kay (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). J. Inst. Metals 86, 379-84(1958) Apr.

The possibility of a plutonium specimen disintegrating owing to the production, from radioactive decay, of helium within its volume is discussed. Order-of-magnitude estimates, based on a number of simplifying assumptions, indicate that disintegration should not occur in times of less than one or two centuries. An adiabatic method is described for measuring the specific heat of plutonium which makes use of the self-heating of the metal to raise the temperature of the specimen. Results are given for the α phase above room temperature, including an estimate of the $\alpha \rightarrow \beta$ heat of transformation. Preliminary experiments on the oxidation of plutonium in air are described, with results covering the range 40 to 487°C. These are useful for gaining an over-all impression of the behavior of the metal. At low temperatures absence of moisture inhibits oxidation of plutonium, and evidence is given that oxidation in the δ-phase temperature range proceeds at a much lower rate than that in either of the adjacent phase ranges. (auth)

9101

THE DEVELOPMENT OF HANDLING TECHNIQUES FOR THE STUDY OF PLUTONIUM METAL. W. B. H. Lord (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.) and M. B. Waldron (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inst. Metals 86, 385-92(1958) Apr.

Metallurgical studies of plutonium are complicated by its fissionable nature, its extreme radioactive toxicity, and its ready oxidation to form a fine powder. Since 1951, when plutonium first became available in Great Britain there has been a steady development in the methods of handling it. The first installations were based on the use of fixed cells, which were operated through gloves from one face, and to which access could be gained by men in pressurized suits for maintenance. With increasing experience, island cells, operated from two opposite faces, and free-standing glove-boxes, with all-round glove-access, were developed. The relative merits of the various arrangements are discussed. Special features of the ancillary equipment are outlined. (auth)

Tritium and Tritium Compounds

9102 UCRL-5069

[California. Univ., Livermore. Radiation Lab.] TRITIUM. [A Bibliography]. Maggie Cason. Mar. 12, 1957. 8p. Contract [W-7405-eng-48]. (M-6302). $1.80 (ph OTS); $1.80(mf OTS).

This is a selective bibliography of books, periodical articles, and technical reports relating to tritium with special reference to urine analysis of tritium and metabolic experiments. Sources consulted include: The library card catalog; the information division AEC card catalog; Chemical Abstracts, 1954 to 1955; Nuclear Science Abstracts, 1955 to 1956. (auth)

Uranium and Uranium Compounds

Refer also to abstracts 9021, 9176, 9551, and 9554.

9103

THERMOGRAVIMETRIC CONTROL OF THE INTERMEDIATE PRODUCTS OF THE METALLURGY OF URANIUM. L. Gascó Sánchez and R. Fernández Cellini (Junta de Energia Nuclear, Madrid). Anales real soc. espaň. fís. y quím. (Madrid) B54, 181-90(1958) Mar. (In Spanish)

The thermal decomposition of some intermediate compounds in the metallurgy of uranium, as uranium peroxide, ammonium uranate, uranium and ammonium pentafluoride, uranium tetrafluoride, and uranous oxide has been studied by means of the Chevenard thermobalance. Some data on pyrolysis of synthetic mixtures of intermediate compounds, which may occasionally appear during the industrial process, are given. Thermogravimetric methods of control are suggested, usable in products in uranium metallurgy. (auth)

9104

FURTHER STUDIES OF THE URANYL COMPLEX OF TRIOSE-REDUCTONE. J. Hojman, V. Dražić and A. Muk. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 23-30(1958) Mar.

The spectrophotometric and polarographic determination of uranyl ion as reductone complex was investigated. For the concentration ranges 1.8×10^{-5} to 1.0×10^{-4} g/ml I_d/C is constant. The thermodynamic dissociation constant of reductone was determined at 15°, 25°, and 33°C. The apparent dissociation constant of uranyl reductone complex was determined at $\mu = 0.1$ and a temperature of 25°C. (auth)

9105

EFFECT OF DILUENTS ON THE EXTRACTION OF URANYL NITRATE WITH TRIBUTYL PHOSPHATE. Zdenko I. Dizdar, Jelena K. Rajnvajn, and Olga S. Gal. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 59-66(1958) Mar.

At lower concentrations of uranium ($\leq$ 150 g/l) the extraction of uranyl nitrate with tributyl phosphate (TBP) depends very much on the nature of diluents used. The greatest extraction ability is shown by TBP diluted with carbon tetrachloride, than with xylene, kerosene, hexane, dibutyl ether, diethyl ether, and isopropyl ether. At greater uranium concentrations these differences disappear. (auth)

9106

AN ATTEMPT TO EXTRACT URANIUM FROM SULFATE SOLUTIONS WITH TRIBUTYL PHOSPHATE. U. Veereswararao. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 75-83(1958) Mar.

Distribution of uranyl sulfate between 30% TBP(v/v) in kerosene and different aqueous H_2SO_4 solutions with and without the addition of NaCl was studied. The partition of the other elements that usually accompany uranium was also investigated under the same conditions as those for uranium in the presence of sodium chloride. A method for the elimination of the interference of Fe in the extraction of uranium is suggested. (auth)

9107

X-RAY ANALYSIS OF AMMONIUM URANYL CARBONATE. Stjepan S. Malčić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 95-7(1958) Mar. (In German)

X-ray analysis of ammonium uranyl carbonate,

$(NH_4)_4UO_2(CO_3)_3$, gave the following measurements for the unit cell: a = 10.650 ± 0.015 A, b = 9.360 ± 0.015 A, c = 12.845 ± 0.015 A, and β = 96°24′ ± 6′. The number of the formula unit per cell is Z = 4. The density calculated from the x-ray data is 2.74. The diffraction symbol and the spatial group are given. The x-ray data were obtained from the oscillating crystal absorption on the b and c axes, as well as Weissenberg absorption of the equator, and of the first and second layer lines along the same axes with copper radiation (λ = 1.5418 A). (tr-auth)

9108

X-RAY ANALYSIS OF POTASSIUM URANYL CARBONATE. Stjepan S. Malčić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 99-104(1958) Mar. (In German)

An investigation of the potassium uranyl carbonate $K_4UO_2(CO_3)_3$ showed that for the hexagonal compound it is monoclinic and is isotopic with the corresponding ammonium salt. The x-ray analysis gave the following measurements for the unit cell: a = 10.22 ± 0.01 A, b = 9.18 ± 0.02 A, c = 12.18 ± 0.01 A, and β = 94°47′ ± 6′. The number of the formula unit per cell is Z = 4. The density was determined as 3.450 g/cm^3, while the density calculated from x-ray data was 3.54 g/cm^3. On the basis of the systematic diffraction, the diffraction symbol and the characteristic spatial group were found. The x-ray data were obtained from the rotational crystal absorption along the b and c axes, as well as from the Weissenberg absorption of the equator and of both first layer lines along the same axes with copper radiation (λ = 1.5418 A). (tr-auth)

9109

X-RAY DATA FOR URANYL DISALICYLATE DIHYDRATE. Ljubica M. Manojlović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 105-7(1958) Mar.

X-ray analysis of uranyl disalicylate dihydrate, $UO_2(C_6H_4OHCOO)_2 \cdot 2H_2O$, showed that it crystallizes in the triclinic system, with unit-cell dimensions: a = 6.49 ± 0.02 A, b = 7.87 ± 0.03 A, c = 9.00 ± 0.03 A, α = 114° 34′ ± 43′, β = 97° 20′ ± 39′ and γ = 95° 9′ ± 48′. There is one molecule per unit cell. X-ray calculated density is found to be d_c = 2.377 ± 0.009 g/cm^3. On the basis of crystal morphology and positive pyroelectric effect, the possible space group is C_1^1 – P1. (auth)

Waste Disposal

Refer also to abstract 9552.

9110 AECU-3676

California. Univ., Berkeley. Dept. of Engineering. UTILIZATION OF SOLAR ENERGY FOR WASTE RECLAMATION. Harold B. Getaas and William J. Oswald. [1955?]. 28p. $4.80(ph OTS); $2.70(mf OTS).

Basic rational formulations for the design of a process for growing algae in liquid animal, industrial, and home food processing wastes are presented. The derivations utilize the law of conservation of energy, data on available solar energy, light transmitting characteristics of algal cultures, and experimental data resulting from laboratory and pilot plant investigations of algal culture in liquid wastes. Much additional data concerning the interrelationship of the different variables and their quantitative values for different conditions are necessary for further refinement of design calculations. Nevertheless, pilot plant operation experience has shown that the process can be designed and operated in accordance with these criteria. Through the use of this process, a large part of the nutrients in municipal sewage and many industrial wastes can be converted to algal cells and waste treatment simultaneously effected. Yields of algal cells and of crude protein, much higher than those now achieved by usual agriculture methods, are obtained. (auth)

9111 CF-8021

Gt. Brit. Windscale Works, Sellafield, Cumb., England. FACTORS AFFECTING THE DISSIPATION OF WINDSCALE RADIOACTIVE EFFLUENT IN THE IRISH SEA. A. E. Shaw and F. R. Charlesworth. Feb. 20, 1952. 43p.

The dissipation of effluent into sea water by initial dilution, eddy diffusion, and residual currents was originally assessed by Seligman and Scott in 1948. Further experimental work is described which has enabled a new assessment to be made. This work has included a measurement of the initial dilution of fresh water from the pipe line, and a study of the movement of water as indicated by drift bottles. It is now envisaged that initial dilution, by a factor of 10^4, will be followed by eddy diffusion with the coefficients as measured by Seligman, and bulk movement primarily due to the force of the wind. Exceptions will occur when defined calm conditions exist. The discharged effluent will then tend to float on the surface with an initial dilution factor of only a few hundred and successive tidal releases will pour into the diffusing remains of the previous activity, there being no indications of residual currents. No work has been done to see if this more concentrated effluent can come ashore without further dilution. It is recommended that, to avoid floating effluent, water should not be discharged during very calm weather. Maximum storage space can be assured by normally pumping effluent to sea at the next high tide after treatment. (auth)

9112 CF-58-4-74

Oak Ridge National Lab., Tenn. SUMMARY OF SUMMER WORK ON THE INCORPORATION OF RADIOACTIVE ISOTOPES IN CERAMIC MASSES. Gilbert C. Robinson. Apr. 16, 1958. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Concretes containing portland cement and vermiculite as the solid material and radioactive waste as the makeup liquor were prepared to study the effect of concrete composition on retention of radioactive wastes. The tests indicated that vermiculite-concrete could successfully contain radioactive waste against water leaching if the concrete were fired to 1200°C. The tests also indicated that vermiculite-concrete containing attapulgite gave a lower count lixivium. It was not clear whether this resulted from the presence of the attapulgite or from the use of a higher solids-to-waste ratio. Experiments were made to determine how effectively porous ceramic bodies can tie up radioactive wastes. Two procedures were utilized: one in which the porous body was used as a wick (one end kept dry), and the other in which the entire piece was immersed in the waste solution, fired, and re-immersed for a total of four cycles. (W.L.H.)

9113

HANDLING AND DISPOSAL OF RADIOACTIVE WASTES. John F. Newell (U. S. Atomic Energy Commission). Am. Ind. Hyg. Assoc. J. 19, 31-5(1958) Feb.

The purpose and scope of research and development activities in the field of waste disposal carried out by the Atomic Energy Commission are summarized. (C.H.)

ENGINEERING

9114 AERE-ED/M-9

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England. SOME DEVELOPMENTS ON A DESIGN OF LIQUID METAL

VALVE. F. L. Speed and K. A. Tomblin. Mar. 1954. 14p.

Some developments which have been carried out on a valve designed for use with liquid metals which solidify above room temperature are described. The valve is constructed so that the freezing properties of the liquid metal are used to seal the valve gland under operating conditions. The design of a flanged joint for use in liquid metal circuits is also described. (auth)

9115 DTMB-826

David W. Taylor Model Basin, Carderock, Md.
ANALYSIS OF STRESSES AT THE REINFORCED INTERSECTION OF CONICAL AND CYLINDRICAL SHELLS. Edward Wenk, Jr. and C. E. Taylor. Mar. 1953. 27p.

Approximate equations are developed for the equilibrium of complete conical shells, and the results are extended for the practical stress analysis of cone-cylinder intersections reinforced with ring stiffeners. The effects of the approximation are explored to determine geometries for which the analysis is valid. For several examples of cones of certain shapes, the approximate theory gave results in good agreement with the relatively exact solution of Dubois. The derived coefficients of edge displacements and rotations provide a convenient method for analyzing the strength of pressure vessels which incorporate conical components. (auth)

9116

HOW TO USE MASS TRANSFER COEFFICIENTS. James O. Osburn (State Univ. of Iowa, Iowa City). Chem. Eng. 65, No. 10, 169-72(1958) May 19.

Steady-state mass-transfer information needed in the design of gas absorption, extraction, drying, crystallization, and distillation equipment may be obtained through the use of mass-transfer coefficients. The proper application of these coefficients and the calculational methods employed are presented and discussed. (D.E.B.)

9117

PETROLEUM LUBRICANTS. THEIR APPLICATION IN NUCLEAR PLANT. C. H. Nailer (Shell-Mex, Ltd.). Nuclear Eng. 3, 203-6(1958) May.

The general application of petroleum-based oils and greases to meet the arduous conditions imposed by radiation and the suitability of certain types of lubricants are reviewed. (auth)

Heat Transfer and Fluid Flow

Refer also to abstract 9555.

9118 AECU-3600

Columbia Univ., New York. Engineering Research Labs.
TRANSIENT HEAT TRANSFER IN REACTOR COOLANT CHANNELS. Ralph P. Stein. Oct. 31, 1957. 42p. Contract AT(30-3)-187. (CU-34-57-AT-187-Ch.E). $1.25 (OTS).

An analysis is presented of the transient behavior of a generalized coolant channel neglecting temperature dependent reactivity changes. The analysis is applicable to forced convection cooling of heterogeneous reactor fuel elements or electrically heated simulation thereof. Derivations are given for cases of variation of coolant inlet temperature and of heat generation. An approximation is also developed applicable to thin fuel elements. From this, solutions are obtained for cases of impulsive, step, linear, and step-exponential variations of inlet temperature, and, of impulsive and uniform variations of heat generation. The solutions presented will be of use during preliminary stages of design of new heterogeneous reactor concepts (when the use of computing machines may not be warranted), and, in the design and interpretation of transient experiments simulating reactor fuel channels. (auth)

9119 BW-5433

Babcock and Wilcox Co. Research Center, Alliance, Ohio.
CS-2 NUCLEATE BOILING TEST. E[arl] Howells. June 3, 1957. 27p. For Westinghouse Electric Corp. [Atomic Power Div.]. Subcontract No. 73-14-433. $4.80(ph OTS); $2.70(mf OTS).

When corrosion products from a carbon steel system deposit on Zircaloy-2 heat transfer surfaces subjected to nonboiling and nucleate boiling water, no significant decrease in the over-all heat transfer coefficient occurs in 2800 hr under the test conditions used in this program. Pressurized water heated to about 600°F will react with Zircaloy-2 to form zirconium hydride. More hydride is formed when a nucleate boiling condition exists. These tests indicate that carbon steel can be used in place of stainless steels to fabricate some components of a pressurized water reactor system without fear of blocking flow passages or causing overheating of fuel elements due to decrease in the over-all heat transfer coefficient providing the coolant water has a pH of 10. Materials will preferentially deposit on heat transfer surfaces where nucleate boiling occurs. (auth)

9120 BW-5435

Babcock and Wilcox Co. Research Center, Alliance, Ohio.
STEAM–WATER MIXTURE DENSITY STUDIES IN A NATURAL CIRCULATION HIGH PRESSURE SYSTEM. Final Report. T. A. Hughes. Feb. 25, 1958. 50p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 564. $7.80(ph OTS); $3.30(mf OTS).

Tests were run on a 6.625 in. ID vertical pipe at pressures of 1200, 1400, 1800, and 2400 psia and steam and water flow rates of 1,000 to 5,880 lb per hour and 20,000 to 60,000 lb per hour, respectively. Water and steam were mixed immediately below the test section and flowed vertically upward. Observations were made at five stations along the length of the test pipe. The observed steam and water flow rates and densitometer measurements through the center of the pipe were used to calculate the per cent steam by weight input, void fraction, slip velocity (difference between steam and water velocities), and the centerline density as measured by the densitometer. (auth)

9121 CF-58-2-40

Oak Ridge National Lab., Tenn.
MOLTEN SALT HEAT TRANSFER. H. W. Hoffman. Feb. 18, 1958. 32p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

The experimental system used in the determination of turbulent forced-convection heat-transfer coefficients with molten salts is described, and the results of the experimental program are detailed. The salts studied have been the mixtures $NaNO_2-NaNO_3-KNO_3$, $LiF-NaF-KF$ and $NaF-ZrF_4-UF_4$, and sodium hydroxide. Low results with the $LiF-NaF-KF$ mixture in Inconel tubes are explained in terms of an interfacial film. A nonwetting phenomenon is postulated to describe the decreased heat transfer in the $NaF-ZrF_4-UF_4$ system. The advantages of molten salts as coolants are briefly discussed. It can be concluded that molten salts behave, in general, as ordinary fluids ($0.5 < N_{Pr} < 100$) as far as heat transfer is concerned. An analysis has shown that the molten salts compare favorably with the liquid metals as reactor coolants. (auth)

9122 KAPL-1797

Knolls Atomic Power Lab., Schenectady, N. Y.
DESIGN, FABRICATION, AND PERFORMANCE OF THE DUPLEX HEAT TRANSFER TUBE. F. J. Mehringer. Sept. 28, 1956. Decl. Apr. 4, 1958. 60p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60(mf OTS).

The heat transfer characteristics and stress levels in duplex tubes for heat exchangers are interdependent. This

summary assembles into a single report the various studies of the heat transfer characteristics and stress analyses that have been made. The heat transfer characteristics discussed are those for boiling water, liquid metal, and metal-to-metal contact. Analyses have also been made of the fabrication and operating stresses. As a result, recommendations have been made regarding material properties, tolerances, and surface conditions of the tubular components, fabricating procedures, and operating precautions. Where areas of uncertainty still exist, tests have been recommended. This information is significant to the S1G Test Steam Generator Program, since this steam generator is to have duplex heat exchanger tubes. (auth)

9123 KAPL-M-S3G-RES-54
Knolls Atomic Power Lab., Schenectady, N. Y.
LARGE SCALE RIBBON MASS TRANSFER TEST. R. Ostrowski. Mar. 24, 1958. 31p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

Results are reported of tests performed at KAPL based on a mass transfer-heat transfer analogy using copper surfaced elements subjected to air streams containing H_2S gas. The test equipment and procedure are described and data of spectrophotometer readings versus periphery are plotted to show qualitative results. Quantitative correlations between results and heat transfer coefficients were not arrived at. (auth)

9124 NACA-TN-3792
Ames Aeronautical Lab., Moffett Field, Calif.
A THEORETICAL ANALYSIS OF HEAT TRANSFER IN REGIONS OF SEPARATED FLOW. Dean R. Chapman. Oct. 1956. 47p.

An analysis is made of the rate of heat transfer to regions of separated flow in compressible streams. The physical mechanism postulated applies in principle to both laminar and turbulent flow, and to conditions where gas is injected into a separated region. Under the special condition of zero boundary-layer thickness at the separation point, the analysis yields relatively simple equations. Detailed calculations are presented for laminar separations in compressible flow with Prandtl numbers between 0.1 and 10.0. (auth)

9125 NACA-TN-3969
Ames Aeronautical Lab., Moffett Field, Calif.
A THEORETICAL STUDY OF THE EFFECT OF UPSTREAM TRANSPIRATION COOLING ON THE HEAT-TRANSFER AND SKIN-FRICTION CHARACTERISTICS OF A COMPRESSIBLE, LAMINAR BOUNDARY LAYER. Morris W. Rubesin and Mamoru Inouye. May 1957. 41p.

A compressible, laminar boundary layer on a flat plate is considered. The flat plate is divided into two regions: an upstream region of finite length which is porous and transpiration cooled with air, and a downstream region which is nonporous and is protected by the upstream cooling process. (auth)

9126 WADC-TN-58-123
Aerojet-General Corp., Azusa, Calif.
EXPERIMENTAL STUDIES ON HEAT TRANSFER AND FLUID FLOW. Quarterly Progress Report No. 1 [for] January 1 to March 31, 1958. E. L. Geery, K. L. Nall, and B. B. Fowler. Apr. 1958. 15p. Project 3151. Contract AF33(616)-5552. (AGC-0140-05-1(Vol. II)).

A series of rocket-nozzle flow-separation and transpiration-cooling tests at a stagnation-gas temperature of 500°F were completed for stagnation chamber pressures of 250, 300, 350, and 400 psig and for injection pressures of 0, 25, 50, and 100 psig. Preliminary data indicate that the separation process may be more abrupt for hot-gas flow than for cold-gas flow, and that transpiration-cooling of the nozzle wall is extremely effective in lowering the wall temperature. Equipment which is being prepared for the determination of heat-transfer properties of a cryogenic fluid in the critical region is described. (auth)

9127 AEC-tr-3246
FLOW IN STEAM-PRODUCING, PARALLEL-CONNECTED TUBES. INFLUENCE OF TUBE NOZZLES ON THE WATER CIRCULATION. Heinrich Vorkauf. Translated from Arch. Warmewirtsch. u. Dampfkesselw. 18, 75-7 (1937). 8p.

It is known that in the case of forced circulation boilers, nozzles are used at the water intake to the tubing or groups of tubes. Their use is considered essential only for the correct distribution of water to the individual, differently heated tubes or groups of tubes. The experiments described show that even with uniform heat absorption of the tubes, the installation of nozzles can not be done away with, but is necessary in order to obtain a constantly even flow in all tubes. (auth)

9128 NP-tr-65
STUDY OF THE HYDROMECHANICS OF SUSTAINING CYCLONES FOR STEAM BOILERS. O. M. Baldina. Translated by R. C. Murray from Energomashinostroenie, No. 10, 13-17(1956). 15p.

In sustaining cyclones with bottom-connected discharge pipes, a vortex is formed which at high flows of water through the cyclones causes deep 'funnelling' along the cyclone axes. Measurements of water level in such cyclones should be made along the centerlines. This phenomenon does not occur in cyclones having lateral discharge. Entry of steam into cyclone discharge pipes upsets normal feed of water to the baffles and can disturb the circulation in them. It is essential to fit special baffles near the base which prevent funnelling in bottom-discharge cyclones. The minimum dimensions of these baffles, as checked on working boilers, should be height = internal diameter of cyclone, and radial width one third this diameter. The baffles should be fitted radially and can be diametral cross-pieces, or crosses consisting of two cross-pieces. Parallel coupling of cyclones ensures normal running of a boiler system when there are pressure-balancing pipes between the water contents of the cyclones and the steam spaces or steam lead-off pipes of the cyclones are connected. The feed and pressure balancing pipes should be connected to the cyclones not above the damping baffles. With moderate resistances of the steam discharge and feed pipes in cyclones with damping baffles the height of the cyclones below the axis of the boiler drum can be decreased to 2.0 m (6½ ft). An increase of the blow-off from cyclones to 5 to 7 times the normal does no harm to the baffles connected to them. The resistance coefficient of the spiralling device of a cyclone, calculated from a ratio (spiralling cross-section/supply pipe cross section) of 1.35 can be taken as 3.0 relative to the velocity of the mixture in the outlet cross section. (auth)

9129
THE CRITICAL HEAT FLUX FOR BURNOUT IN WATER UNDER CONDITIONS OF RESTRICTED FLOW. B. A. Zenkevich and V. I. Subbotin. Atomnaya Energiya 3, No. 8, 149-52(1957).

An experimental apparatus is described for the study of the transition from bubble formation to complete boiling. The critical thermal stress was computed. (J.S.R.)

Materials Testing

9130 AGARD-113
North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.
STRAIN GAGE CALIBRATIONS AND FLIGHT LOADS

TESTING TECHNIQUES. Norman A. Krause. 1957. 56p.

Presented at Fifth Meeting of the Structures and Materials Panel, Apr. 29 to May 3, 1957, Copenhagen.

The measurement of structural loads in flight is no longer restricted primarily to fundamental flight research, but is rapidly becoming a standard test program on aircraft models destined for production. Military specifications have been developed stipulating requirements for the demonstration of structural integrity through flight loads measurements. Since a flight loads program represents a considerable expenditure of man hours, sound planning, scheduling and selection of instrumentation are stressed. Two basic instrumentation systems for measuring flight loads are being used—the pressure distribution system and the strain gage system—each having certain advantages and disadvantages. This paper deals with experiences with strain gage systems during a number of comprehensive loads programs. Methods of installation and calibration of strain gage systems are discussed. Flight maneuvers and methods of execution to obtain the desired data are outlined and typical test data shown. Techniques used in the handling and analysis of the data are discussed with examples of typical final results showing the concept of testing to 80% limit load and extrapolation to 100% limit load to determine critical load conditions and their magnitude. The use of automatic electronic equipment and other development programs which are improving the efficiency of conducting loads programs are discussed. (auth)

9131 NYO-7978

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.

NON-LINEAR BENDING AND BUCKLING OF CIRCULAR PLATES. Herbert B. Keller and Edward L. Reiss. Feb. 1, 1958. 46p. Contract AT(30-1)-1480. $7.80(ph OTS); $3.30(mf OTS).

An iterative method for solving certain boundary value problems that occur in a non-linear theory of thin elastic plates and shells was developed and applied to obtain numerical solutions of the von Kármán plate equations for a variety of bending and buckling problems. The method and solutions are presented for circular plates subjected to either uniform lateral pressure or uniform edge thrust and with various edge conditions. The solutions yield a complete description of stresses and deflections for an apparently unlimited range of load parameters. Boundary layer phenomena are clearly observed and are discussed. The iterative method proves to be superior to the previously used power series method and it is applicable to other non-linear problems. (auth)

9132 SCL-T-173

OPERATING CHARACTERISTIC CURVE FOR SAMPLING INSPECTION, WHERE EACH PRODUCT IS CHECKED FOR SEVERAL INDEPENDENT QUALITY CHARACTERISTICS. Vratislav Horalek. Translated from Apl. Mat. 1, 431-44 (1956). 14p.

In this article are presented the formulas for calculation of upper and lower bounds between which lies the true operating characteristic curve defined by the controlling process when a separate acceptance criterion is prescribed for each quality characteristic. The solution is given in the case of a single sample acceptance plan with the assumption that the considered characteristics (or group of characteristics) are mutually independent. (auth)

9133

THE ULTRASONIC TESTING OF WELDS. M. J. Cotter. Atomics and Nuclear Energy 9, 115-17(1958) Apr.

The application of ultrasonics to weld inspection is briefly discussed, and the methods used are reviewed. A limited survey is made of the commercial equipment available for ultrasonic testing of welds. (J.S.R.)

Pumps

9134 AEC-tr-3200

ELECTROMAGNETIC PUMPS WITHOUT MOVING PARTS FOR THE CONDUCTION OF LIQUID METALS. (Über Elektromagnetische Pumpen ohne bewegie Teile zur Förderung Flussiger Metalle). Julius Steiner and Hans Hohn. Translated from Chem.-Ing.-Tech. 28, 405-10(1956). 26p.

Structure and method of operation of electromagnetic direct current pumps are briefly described, and the theoretical relationships and problems of economy are discussed. Results are given for several direct-current pumps with permanent magnets and pump bodies of synthetics for the conduction of mercury. (auth)

9135

THE ELECTROMAGNETIC PUMPING OF LIQUID METALS. 2. J. A. S. Hilditch (British Thomson-Houston Co., Ltd., Rugby, Eng.). Atomics and Nuclear Energy 9, 125-7(1958) Apr.

In the second part of a series on electromagnetic pumping of liquid metals, the design and characteristics of the a-c conduction pump and the induction pump are discussed. Possible future developments in the pumping of liquid metals are described. (J.S.R.)

Waste Disposal

9136 UCRL-5068

California. Univ., Livermore. Radiation Lab.

RADIOACTIVE WASTE DISPOSAL. [A Bibliography]. Apr. 25, 1957. 12p. Contract W-7405-eng-48. (M-6301). $3.30(ph OTS); $2.40(mf OTS).

This is a selective bibliography of books and periodical articles relating to radioactive waste disposal. Material in the bibliography is concerned primarily with methods for the handling and disposal of wastes and the results of these methods. Auxiliary material indicating methods of determining radioactivity in wastes has been included. Sources consulted include: Chemical Abstracts, 1950 to 1955; Engineering Index, 1950 to 1955; Industrial Arts Index, 1950 to March 1957; Nuclear Science Abstracts, 1950 to March 15, 1957; Physics Abstracts, 1950 to 1955; the Library card catalog; and the Technical Information Division AEC card catalog. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

Refer also to abstracts 9441 and 9443.

9137 NYO-8530

Penn-Texas Corp., New York.

SLIP CASTING OF CERMETS. Henry H. Hausner. Mar. 31, 1958. 24p. Contract AT(30-1)-1991. $4.80(ph OTS); $2.70(mf OTS).

Tests with stainless steel—Al_2O_3 and stainless steel—UO_2 mixtures have shown that the slip casting process can be applied to mixtures of metallic and ceramic particles, with no regard whether the specific gravity of the ceramic

particles is higher or lower than that of the metallic particles. There are indications that sintering may occur above the melting temperature of the metallic component without any distortion of the specimen shape, if the amount of the ceramic component is high enough. The ductility of a mixture consisting of stainless steel–25 wt. % UO_2 is rather high (8.3% elongation) and may be caused by the special structure of slip cast materials. (auth)

9138 UCRL-5066

California. Univ., Livermore. Radiation Lab.

DIE DESIGN FOR HOT PRESSES. [A Bibliography]. Apr. 19, 1957. 4p. Contract W-7405-eng-48. (M-6300). $1.80(ph OTS); $1.80(mf OTS).

This is a selective bibliography of books and periodical articles relating to die design of hot presses. Sources consulted include: ASM Review of Metal Literature, 1950-1954; Chemical Abstracts, 1950-1955; Engineering Index, 1950-1955; Industrial Arts Index, 1950-March 1957; Metallurgical Abstracts, 1950-1953; Nuclear Science Abstracts, 1950-March 1957; Physics Abstracts, 1950-1955; the library card catalog, and the Technical Information Division AEC card catalog. (auth)

9139 SCL-T-176

PROCEDURE FOR DEPOSITING METAL CARBIDES ON METAL SURFACES. Translation of Italian Patent No. 468,568; issued to Felix Gerin (France)—Granted: Jan. 26, 1952. Translated by Marcel Weinreich. 8p.

The traditional method of coating certain machine parts and utensils with a surface layer of metallic carbides has consisted of applying laminas or lamellas on the tools to be hardened. Besides the fact that the field of application of such processes is most limited, they also present the inconvenience that the carbide layer is not always perfectly homogeneous, and that it may contain gas pores, or even fail to adhere to the utensil. The present process of depositing a coating of metallic carbides on a metal base is free of the above-mentioned drawbacks, and its entirely new principle permits carbides to be deposited in a non-oxidated form, and to possess a molecular structure which assures a hardness unattained heretofore. (auth)

9140

THE MODIFICATION OF ALUMINIUM–SILICON ALLOYS BY SODIUM. R. C. Plumb and J. E. Lewis (Aluminum Co. of America, New Kensington, Penna.). J. Inst. Metals 86, 393-400(1958) Apr.

Measurements by autoradiography and activation analysis have revealed the distribution of sodium in the microstructures of aluminum–7.5% silicon alloys modified by the addition of various amounts of sodium. Electron-microscopic studies indicate that there is no fundamental difference between modification by chill casting and modification by sodium addition. A previously unobserved submicroscopic phase, the amount of which depends on the degree of modification, has been found. New thermal measurements, employing an inert atmosphere to prevent sodium loss, were made. The several types of experimental results have been used to establish the mechanism of modification. A theory of modification similar to an hypothesis advanced by Edwards and Archer is proposed. According to it, the addition of a modifying agent retards nucleation of eutectic silicon at the "unmodified" eutectic temperature and causes solidification to occur at a steady-state temperature considerably below the freezing point, where diffusion is slower and the individual silicon crystals cannot attain so large a size. (auth)

9141

SOME INVESTIGATIONS ON CERAMICS AND CERMET MATERIALS FOR THE PRODUCTION OF BLADES FOR CUTTING TOOLS. W. Richter and G. Kammerich. Silikattechnik 6, No. 12, 528-34(1955). (Translated from Referat. Zhur. Khim. No. 3, 1957, abstract no. 9024).

A survey is made of research on the application of ceramic and cermet materials in the production of cutting tools. The results from research carried out at the Neuhaus Porcelain Factory on the development of corundum cutting edges (with the addition of 1% Fe_2O_3, Ga_2O_3, La_2O_3, Cr_2O_3, or 0.5% MgF_2) and of cermets containing Al_2O_3 plus 2 to 5% Mo are described. The specimens used had the dimensions 26 × 12 × 8 mm. The specimens were pressed from finely ground enriched corundum (with additives) and organic bound and sintered at 820°; the aim was to achieve the finest possible grain for the corundum. Corundum wheels containing Cr_2O_3 and MgF_2 has proven suitable for the cutting of plastics, Mg alloys, and other light alloys but have proven very unstable in the cutting of steels. Cermet wheels were sintered in resistant furnaces (in a carbon tube) at 1800 to 1850° or subjected to hot pressing at 1600° under a pressure of 150 kg/cm^2. The best results in the cutting of steels were obtained with corundum wheels containing up to 20% Cr and hot-pressed Al_2O_3 wheels containing 10% Mo. These materials have withstood the cutting of steel at speeds up to 250 m/min for 40 min. The Cr content of these materials is 20% and the Mo content is 10%. A number of photographs of microsections of the instrument are given with magnifications of 200 and 500 diameters. 26 references.

9142

MANIPERM, A NEW CERAMIC MATERIAL FOR PERMANENT MAGNETS. H. Reppin. Technik, No. 3, 184-5 (1956). (Translated from Referat. Zhur. Khim. No. 3, 1957, abstract no. 8994).

Maniperm, a new material having the properties of a permanent magnet and obtained by the heat treatment of a mixture of Fe_2O_3 and BaO, taken in the correct proportions, is described. Ceramic permanent magnets of the type described have extraordinarily high coercive force and high specific magnetic strength. The eddy current losses in Maniperm are negligible due to its low specific resistivity. The latter characteristic makes possible the application of Maniperm in high-frequency installations. Permanent magnets made from Maniperm have found greatest application in radio receivers, miniaturized electric motors, generators, and the like.

Corrosion

Refer also to abstracts 9007, 9008, 9119, 9123, and 9444.

9143 CF-58-1-72

Oak Ridge National Lab., Tenn.

QUARTERLY REPORT OF THE SOLUTION CORROSION GROUP FOR THE PERIOD ENDING JANUARY 31, 1958. J. C. Griess, H. C. Savage, J. L. English, R. S. Greeley, S. R. Buxton, D. N. Hess, P. D. Neumann, S. E. Bolt, and W. C. Ulrich. Jan. 31, 1958. 69p. Contract [W-7405-eng-26]. $10.80(ph OTS); $3.90(mf OTS).

The corrosion rate was determined and tabulated for stainless steels, nickel alloys, carbon steels, Zircaloy-2, and niobium in boiler water containing various concentrations of oxygen. The corrosion resistance of stainless steels and nickel alloys was compared with the resistance of the austenitic stainless steels in uranyl sulfate at 200 to 295°C. Additional loop runs with UO_3–Li_2CO_3–CO_2 solution have confirmed previous data with regard to its non-aggressive nature to carbon steel. The corrosion of 347 stainless steel was investigated in 0.04M uranyl sulfate containing 0.04M beryllium sulfate and 0.005M copper

sulfate, in 0.075M beryllium sulfate, and in 0.75M beryllium sulfate containing 0.25M dissolved uranium trioxide. Dynamic loop tests showed that increasing the copper concentration to 0.03M or decreasing the uranium concentration to 0.02M in simulated HRT fuel solution (0.04M uranyl sulfate, 0.02M sulfuric acid, and 0.005M copper sulfate) has no significant effect on the solution stability or corrosiveness of the solution. The effect of varying the oxygen concentration between 250 and 2800 ppm in 0.17M uranyl sulfate at 250°C on the corrosion rate of 347 stainless steel was found to be negligible in the absence of added Cr^{4+}. The corrosion rate of 347 stainless steel in dilute sulfuric acid solutions was determined at 250°C. Metallographic examinations have been made of stainless steels and titanium alloys stressed to 75% of their room temperature yield strengths and exposed 19,364 hr to the vapor phase above the HRT solution at 300°C. The effect of preformed films on the stress-corrosion cracking of 347 stainless steel in boiling and aerated HRT core solutions containing 50 ppm of chloride was studied as a function of the prefilming time. The effect of HRT core solution components either singly or in combination on the stress corrosion of 347 stainless steel was examined. In order to determine the susceptibility of 347 stainless steel to cracking in chloride-containing distilled water in the absence of oxygen, tests were run at 300°C in solutions containing 100 ppm chloride at adjusted pH values of 2.8, 6.5, and 10.5. Other stainless steels and nickel alloys were subjected to stress corrosion cracking tests at 300°C in distilled water with 100 ppm chloride at various pH levels. In general, the higher the nickel content, the more resistant the alloy was to cracking. The corrosion behavior of electroless nickel plate on carbon steel was excellent in distilled water at 300°C at adjusted pH levels of 2.5, 7.5, and 10.5. The corrosion of Incoloy, AM-350 stainless steel, Stellites 1, 3, and 98M2, and Rexalloy 33 in HRT core solution was studied. (For preceding period see CF-57-10-80.) (J.S.R.)

9144 CWLR-2210

Chemical Warfare Labs., Army Chemical Center, Md.

EVALUATION OF CANDIDATE COATING MATERIALS FOR THE PROTECTION OF METALS AND NONMETALS FROM FUMING NITRIC ACID. Joseph D. Phillips and Samuel W. LeCompte. Jan. 1958. 52p.

Results are presented of the testing and evaluation of several commercial protective-coating materials for use on stainless steel, carbon steel, aluminum, concrete, and asphalt to prevent their corrosion by fuming nitric acid. (auth)

9145 HW-55352

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INTERGRANULAR CORROSION OF ALUMINUM–URANIUM AND ALUMINUM–SILICON–URANIUM ALLOYS. H. C. Bowen and R. L. Dillon. Mar. 14, 1958. 10p. Contract W-31-109-Eng-52. $0.50(OTS).

Aluminum–uranium and aluminum silicon uranium alloys were tested to determine their short term resistance to intergranular corrosion in 350°C water. One-day tests were performed both on bare material and on cores canned in pre-defected Zircaloy-3 jackets. The alloys were tested in both the as-cast and wrought condition. None of the clad alloys showed any distortion when the defect in the jacket was small (1/16-in. diameter). All aluminum–silicon alloys tested showed good resistance to intergranular attack in all tests; however, silicon alloys present separation problems. Cast aluminum alloys with uranium concentrations of 6 wt. % or more showed resistance comparable to the aluminum–silicon alloys. (auth)

9146 KAPL-M-HOS-4

Knolls Atomic Power Lab., Schenectady, N. Y.

CHROMIUM PLATING FOR PROTECTION AGAINST STRESS CORROSION CRACKING OF HARDENED AISI 410 STEEL. Henry Suss. Apr. 22, 1958. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Because of its high corrosion resistance properties, chromium electroplate should offer protection to AISI 419 steel against stress corrosion cracking. Tests have been made (KAPL and Bettis) on chromium plates on test specimens as deposited by two different sources in conformance with Bettis and USMC specifications. These deposits either offered protection to hardened (RC36-42) AISI 410 against stress corrosion cracking, or caused accelerated stress corrosion cracking under conditions which did not crack unplated material. At present there is no significant data which could give definite clues for these extreme differences in the corrosive protective values. The results of tests so far strongly question the value of chromium plate as a means to protect AISI 410 against stress corrosion cracking. (A.C.)

9147 NDA-084-4

Nuclear Development Corp. of America, White Plains, N. Y.

RESISTANCE OF BARRIER MATERIALS TO SODIUM JET IMPINGEMENT. Feb. 26, 1958. 48p. Contract AT(30-3)-256. $7.80(ph OTS); $3.30(mf OTS).

Preliminary screening tests were made with several materials to provide an index of their suitability as barrier materials for use in the SDR. The tests were made by directing a jet of sodium through a $^{3}/_{32}$-in. diameter nozzle at uncooled 2 in. by 2 in. plate specimens; the sodium jet conditions included temperatures from 950 to 1140°F, velocities up to 50 fps, and impingement times ranging from 15 min to 18 hr. A summary of tests made and their results is presented. It was found that aluminum performed well in these tests. No failure of samples having practical thicknesses occurred at 950°F in tests which ranged up to 18 hr. Failure was finally effected at 950°F with a 5-mil aluminum sample. It was found that 0.060 in. aluminum plate also performed well at 1050°F; the maximum test time at this temperature was $3^{1}/_{2}$ hr. One sample was tested at 1140°F and lasted for the length of the test (15 min), but one sample tested at 1100°F failed after 3 hr. (The maximum sodium temperature expected in the SDR is 1025°F.) Zirconium and steel performed well, as was expected. While graphites in general performed poorly, AGOT-type (reactor grade) performed well enough to indicate that it may be developed into a suitable high-temperature barrier. (auth)

9148 NP-6687

Ohio State Univ. Research Foundation, Columbus.

MECHANISM OF STRESS CORROSION OF AUSTENITIC STAINLESS STEELS IN HIGH-TEMPERATURE CHLORIDE WATERS. Technical Report No. 2. R. W. Staehle, F. H. Beck, and M. G. Fontana. Apr. 1958. 32p. Project No. NR-036-006/10-24-55. Contract Nonr-495(11).

Stress-corrosion cracking of austenitic stainless steels was studied under various conditions of stress, chloride concentration, complete immersion of specimens, intermittent wetting and drying, and presence of oxygen. Stress-corrosion cracking will occur at stresses as low as 2,000 psi at 50 ppm NaCl. A three-dimensional analysis of stress-corrosion cracks was made and a mechanism of cracking proposed. (auth)

9149 RAE-TN-MET-124

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

REACTIONS OF CARBIDES WITH GASES AT ELEVATED

TEMPERATURES. PART I. BEHAVIOUR IN OXIDISING ATMOSPHERES. G. H. Cockett and W. Watt. Apr. 1950. 23p.

Sintered compacts of the carbides of titanium, zirconium, niobium, tantalum, vanadium, chromium, and boron were tested for oxidation resistance in air. Zirconium, niobium, tantalum and vanadium carbides have a high rate of oxidation in air at 800°C. Chromium carbide has a very low rate of oxidation at temperatures up to and including 1000°C. At 900 and 1000°C titanium carbide has a linear oxidation rate which is probably too high for practical applications in oxidizing atmospheres. The oxidation of boron carbide in the range 900 to 1000°C is complicated by the volatilization of boric oxide, one of the oxidation products. (auth)

9150 WAPD-NCE-8129

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. PENETRATION OF SURFACE CORROSION-TYPE STRINGERS IN INERT-ATMOSPHERE ARC-MELTED ZIRCALOY-2. F. R. Lorenz. Mar. 31, 1958. 12p. $3.30(ph OTS); $2.40(mf OTS).

Gas-void stringers are discrete, and the corrosion product which forms on or in them is restricted to the locale of the stringer. There is no evidence of any relationship of penetration of oxide as a function of time in corrosion test for times greater than 14 days in 750°F steam. In no case was any oxidized stringer observed to propagate a crack. The average size of a stringer observed in a sample of 15 fuel element punchings from an S3W core was 0.022 in. long × 0.0007 in. wide × 0.0004 in. thick. The maximum size stringer was 0.0700 in. long × 0.0019 in. wide × 0.0006 in. thick. (auth)

9151

NEW ALLOY STEELS BEAT PROCESS BURGABOOS. D. B. Roach and A. M. Hall (Battelle Memorial Inst., Columbus, Ohio). Chem. Eng. 65, No. 10, 180, 182, 184(1958) May 19.

A discussion of stainless steel corrosion is presented with an analysis of developments in corrosion prevention. Illustrative members of several classes of stainless steel including low carbon steels, low nickel high manganese steels, and steels stabilized with niobium or niobium and tantalum are described. (J.R.D.)

9152

CORROSION AND THE DESTINATION OF CORROSION PRODUCTS IN A HIGH PRESSURE POWER PLANT. Ross C. Tucker (Niagara Mohawk Power Corp., Oswego, N. Y.). Corrosion 14, 209t-12t(1958) May.

Methods used to reduce corrosion in a high-pressure steam generating plant are reviewed. Factors involved in the formation, transportation and deposition of corrosion products within the plant's cycle are discussed in detail. Attention is given in the discussion to such matters as water conditioning, feedwater and steam concentrations, corrosion of steam lines, turbine blade deposits, the collecting of dissolved gases in condensers, and dissolved oxygen scavengers. Under certain abnormal conditions (erection of plant, low load operation, and shut-down periods), the chemist may have relatively little control over the corrosion occurring. (auth)

9153

METHODS FOR INCREASING THE CORROSION RESISTANCE OF METAL ALLOYS. N. D. Tomashov (Inst. of Physical Chemistry, Academy of Sciences, Moscow). Corrosion 14, 229t-36t(1958) May.

A detailed investigation is made of the general laws governing the increase of corrosion resistance of metallic systems by means of alloying. The role of local cells in alloy corrosion is considered briefly. Some attention is given also to the control characteristics of corrosion processes. Other topics discussed include structural heterogeneity and metal alloy corrosion resistance, conditions for development of metal passivity, and methods of increasing metal and alloy corrosion resistance. It was found that with corrosion controlled by oxygen diffusion, cathodic inclusions do not notably accelerate corrosion. When it is possible to establish prevalent anodic control, cathodic inclusions may promote passivation and consequently considerably reduce the rate of corrosion. The degree of passivity may be regarded as a value equivalent to the degree of anodic control effected in a given process. When this is taken into account it is possible to propose a new method for calculating the degree of passivity of different metals. Approximate calculation of the passivity of metals in aerated 0.5N NaCl solutions gave the following order of reduction of degree of passivity: Ti, Al, Cr, Be, Mo, Mg, Ni, Co, Fe, Mn, Zn, Cd, Sn, Pb, and Cu. The possibility of increasing alloy corrosion resistance by additional cathodic alloying was interpreted by analyzing the polarization diagram. The possibility of increasing the corrosion resistance of readily passivated metallic systems was tested experimentally. (auth)

9154

THE MECHANISM OF STRESS CORROSION OF AUSTENITIC STAINLESS STEELS IN HOT AQUEOUS CHLORIDE SOLUTIONS. K. W. Leu and J. N. Helle (Koninklijke/Shell-Laboratorium, Amsterdam). Corrosion 14, 249t-54t (1958) May.

An investigation into the mechanism of transcrystalline stress corrosion of austenitic stainless steels (18 Cr/8 Ni and 25 Cr/20 Ni) in hot aqueous chloride solutions has shown that this phenomenon must be described as being a process alternating between corrosion and mechanical cracking. Only sharp-edged pits formed by a specific corrosive attack initiate and propagate the mechanical cracking. These pits act as stress raisers; the conditions for notch brittleness of the materials involved are produced, so that mechanical cracking occurs, which is of a brittle nature. At high stresses small pits occurring either at the slip bands or at the grain boundaries may cause cracking, whereas at low applied stresses, only longish pits formed at the slip bands initiate it. The investigation proves that the initial corrosive attack is dependent primarily on the mechanical and chemical behavior of the passivating film already present on the steel or formed during exposure to the corrosive medium, and only to a minor extent on the structure of the metal itself. If the type of initial corrosive attack is changed by comparatively small alterations in the composition of the corrosive medium, stress corrosion is either prevented or accelerated. Tests illustrating this observation are discussed. (auth)

9155

CORROSION INHIBITION BY ORGANIC AMINES. Helmut Kaesche and Norman Hackerman (Univ. of Texas, Austin). J. Electrochem. Soc. 105, 191-8(1958) Apr.

The corrosion of pure iron in 1N HCl is discussed in terms of the theory of mixed potentials and the theory is applied to inhibition by organic compounds. Corrosion rates with and without inhibition by aniline, several aniline derivatives, and alkylamines were determined by cathodic polarization measurements as well as by colorimetric analysis of the solution. It is shown that all compounds show a maximum inhibitor efficiency at a concentration of approximately 0.1 mole/l, that with one exception all are cathodic as well as anodic inhibitors, and that in most cases they are predominantly anodic inhibitors. An interpretation of the data on cathodic inhibition is suggested on the basis of the assumption of a uniform metal surface and

uniform adsorption. The interpretation of anodic inhibition is found to be difficult due to a lack of satisfactory experimental data. (auth)

9156

LOCAL CELL ACTION DURING THE SCALING OF METALS. I. Christa Ilschner-Gensch and Carl Wagner (Massachusetts Inst. of Tech., Cambridge). J. Electrochem. Soc. 105, 198-200(1958) Apr.

When a tantalum wire partly covered by silver is exposed to iodine vapor at 174°C, a AgI layer is formed not only on silver but also rapidly along the tantalum surface by virtue of local cell action involving migration of silver ions in AgI and migration of electrons in the tantalum wire and across the AgI layer. The observed rate of sidewise growth of the AgI layer along the tantalum surface is in accord with theoretical calculations. By and large, local cell action may increase the rate of dry corrosion when there are different phases, one of which involves easy flow of ions and another involves easy flow of electrons. (auth)

Geology and Mineralogy

9157 RME-3122(Pts. I and II)

Pennsylvania State Univ., University Park. Coll. of Mineral Industries.

PETROGRAPHICAL INVESTIGATIONS OF THE SALT WASH SEDIMENTS. Annual Technical Report for April 1, 1954 to April 1, 1955. Parts I and II. J. C. Griffiths, J. A. Cochran, J. J. Hutta, and R. Steinmetz. (Pt. I, May 1954 and Pt. II, Dec. 31, 1955). 154p. Contract AT(30-1)-1362. $0.75(OTS).

Part I of this report deals with mineral composition and grain packing characteristics of 50 samples of Salt Wash sediments, 25 of which were ore-bearing and 25 barren. To complete the petrographic description of these 50 samples Part II contains a description of the size and shape distributions and the orientation of the grains in these sediments. (auth)

9158 NP-tr-72

CHANGES IN THE STRUCTURE AND PROPERTIES OF BERYLS WITH INCREASING ALKALI CONTENT. T. A. Sosedko. Translated from Zapiski Vsesoyuz. Mineral. Obshchestva 86, 495-9(1957). 5p.

To elucidate the value of the alkalies in beryl and their effect on its crystal structure, x-ray investigations were performed on three specimens of beryl with different contents of the alkali metals (lithium, sodium, and cesium). Results are tabulated. (W.L.H.)

9159

CHROME MICA-CLAY, TEMPLE MOUNTAIN, UTAH. Paul F. Kerr and P. K. Hamilton (Columbia Univ., New York). Am. Mineralogist 43, 34-47(1958) Jan.-Feb.

Chrome mica-clay occurs at Temple Mountain, Utah in association with uranium mineralization. It contains approximately 0.4 to 0.6% Cr_2O_3 and consists of mixed $2M_1$ and 1M mica polymorphs. These mixed polymorphs differ from the well-crystallized single polymorph chrome micas, mariposite and fuchsite. At Placerville, Colorado a similar chrome mica-clay contains as much as 20% interlayered expanding lattice material. Recorded data on synthesis suggest that a likely source of these chrome mica-clays would be hydrothermal chromium-bearing solutions. (auth)

9160

GEOLOGY OF URANIUM OCCURRENCES IN NORTH AND MIDDLE PARKS, COLORADO. Roger C. Malan (U. S. Atomic Energy Commission, Denver, Colo.). Guidebook of the Rocky Mountain Association of Geologists 126-36(1957).

During the last four years, uranium occurrences have been discovered in widely varying geologic settings in or on the fringes of the North and Middle structural basins. In North Park, unidentified uranium minerals are associated with fluorite in the Red Canyon area in western Jackson County and at one mine in the Northgate District at the northern end of the park. Peat beds near Sheep Mountain in the Northwestern part of the basin are mineralized with uranium. In the Beaver Creek drainage in the southern part of Middle Park, uranium is present in a buried carbonaceous zone. Lenses in Tertiary sediments in the Troublesome Creek area in the west central part of the basin contain oxidized uranium minerals. In the Rabbit Ears Pass area in the extreme northwestern corner of the park, bedded uranium deposits are present in the Dakota formation. (auth)

9161

SODIUM AUTUNITE. A. A. Chernikov, O. V. Khutetskaya, and N. I. Organova. Atomnaya Energiya 3, No. 8, 135-40 (1957).

In 1953 a new mineral was found in a Russian mountain range, a hydrous sodium–uranium phosphate. The mineral belongs to the group of uranium micas and is closely related to autunite with respect to its properties. The following experimental data concerning the new mineral are available: (a) chemical composition:

UO_3	61.9 to 62.53%	CO_2	0.24%
P_2O_5	15.56 to 14.69%	MgO	0.43%
Na_2O	5.62 to 6.88%	Al_2O_3	0.32%
CaO	1.2 to 0.14%	Fe_2O_3	0.97%
SiO_2	1.6%	H_2O	13.07 to 14.84%

(b) stoichiometric formula: $Na_2(UO_2)_2(PO_4)_2 \cdot 8H_2O$; (c) specific weight: 3.584 g/cm^3; (d) crystal lattice spacing: a = 6.97 A, c = 8.69 A, c/a = 1.245. (TCO)

9162

REVIEW OF THE BOOK "RADIOHYDROGEOLOGY" BY A. N. TOKAREV, A. V. SHCHERBAKOV, GEOLOGICAL STATE PUBLISHING HOUSE, 1956, 262 PAGES. V. N. Popov. Atomnaya Energiya 3, No. 10, 376-7(1957).

This book is the first of its kind to be published in the Soviet Union. It consists of two parts. The first part contains three chapters: The first chapter discusses the causes of radioactive elements contained in water. The second chapter deals with the problem of various types of natural radioactive water. The third chapter is devoted to hydrogeological conditions which lead to the formation of uranium deposits. The second part consists of six chapters dealing with radiohydrogeological methods of investigation. The book contains both theoretical and a large number of experimental data which were selected by the authors on the strength of their many years of experience. It is a drawback of this book that the text was not sufficiently well revised and corrected. (TCO)

9163

URANIUM DEPOSITS UNDER CONGLOMERATIC SANDSTONE OF THE MORRISON FORMATION, COLORADO AND UTAH. David A. Phoenix (U. S. Geological Survey, Grand Junction, Colo.). Bull. Geol. Soc. Amer. 69, 403-18 (1958) Apr.

In southwestern Colorado and southeastern Utah, strata of conglomeratic sandstone are localized at the base of the Brushy Basin Member of the Morrison Formation of Jurassic age. These discrete lithologic units contain sedimentary structures oriented in a prevailing easterly direction. They are believed to cover about one-third of the underlying Salt Wash Member in southwestern Colorado and southeastern Utah, and they locally rest on ore-bearing sandstone in the Salt Wash Member. Eastward-trending

planar cross-stratification and trough cross-stratification and a general westward coarsening of sediments in the conglomeratic sandstone strata suggest that they are the products of stream aggradation from westerly source areas. Uranium–vanadium deposits in the uppermost, almost continuous, layer of sandstone of the Salt Wash Member are classified according to their association with the conglomerate strata. Of the 363 deposits studied in the uppermost sandstone layer of the Salt Wash Member, 101 are known to be directly beneath conglomeratic sandstone strata, 211 are below the projected extension of conglomeratic sandstone strata, 33 are beyond the safe limits of such projection, and 18 are lateral to the margins of conglomeratic sandstone strata. At places, near clusters of deposits in the uppermost sandstone of the underlying Salt Wash Member, conglomeratic sandstone strata of the Brushy Basin Member are also mineralized. It is postulated that ground-water movement during deposition of the Morrison Formation in Late Jurassic time localized the uranium and vanadium. The direction of this ground-water movement is believed to have been related to streams that deposited the conglomeratic strata, so that in the ore-bearing sandstone metal ions contained in the ground water were localized in places of high transmissibility and in the vicinity of decaying organic debris. According to the age of the ores, precipitation of the metals was much later than their localization, probably during Late Cretaceous or early Tertiary time. (auth)

9164

IDENTIFICATION TABLES FOR URANIUM AND THORIUM MINERALS. A. Volborth (Univ. of Nevada, Reno). Econ. Geol. 53, 300-8(1958) May.

Identification tables for U and Th minerals were prepared to make it possible for a field investigator quickly to assign an unknown radioactive mineral to a certain mineral group. The composition of each known mineral is included as this often enables one to effect an identification by means of a sample chemical test, or at least to reduce the number of possibilities within a given group. The tables also may prove to be useful for rapid identification in the laboratory. (auth)

9165

SUPERGENE COPPER–URANIUM DEPOSITS IN NORTHERN NOVA SCOTIA. J. J. Brummer (Northwestern Explorations, Ltd., Vancouver, B. C.). Econ. Geol. 53, 309-24 (1958) May.

Very low-grade, uneconomic uranium mineralization occurs over a large area of northern Nova Scotia. It is associated with chalcocitized carbonized plant fragments that occur in gray continental sediments of the Pictou Formation (Upper Pennsylvanian). Typically the plant fragments occur in conglomerates, grits or arkoses that fill stream channels in underlying red mudstones. The copper and uranium mineralization are closely associated, are related to the presence or absence of coaly fragments, and are of supergene origin. The deposits investigated proved uneconomic, but are similar to those of the Colorado Plateau region of the southwestern United States. Some 26 shallow drill holes totalling 3,089 feet have been drilled to investigate the deposits. (auth)

9166

THE ISOTOPIC COMPOSITION OF THE NITROGEN IN NATURAL GASES AND ASSOCIATED CRUDE OILS. T. C. Hoering and H. E. Moore (Univ. of Arkansas, Fayetteville). Geochim. et Cosmochim. Acta 13, 225-32(1958).

Measurements of the N^{15}/N^{14} ratio of the nitrogen from a number of samples of natural gas and crude oil show that wide variations exist. A systematic variation in the N^{15}/N^{14} ratio exists across a natural gas field. Experiments on the flow of nitrogen through porous sandstone indicate that two processes could account for the fractionation of the nitrogen isotopes in natural gas, namely effusive flow and surface diffusion. (auth)

9167

VARIATIONS IN THE CONTENT OF NICKEL, GALLIUM, GERMANIUM, COBALT, COPPER, AND CHROMIUM IN THE KAMACITE AND TAENITE PHASES OF IRON METEORITES. Walter Nichiporuk (California Inst. of Tech., Pasadena). Geochim. et Cosmochim. Acta 13, 233-47(1958).

The nickel content of kamacite in hexahedrites and octahedrites has been found to vary within 3.3 to 5.8%. The average of 4.7% of all nickel values is lower than the heretofore reported figure of 5.5 to 6.0%. In the light of the iron–nickel phase diagram the low nickel values in kamacite appear to point to the possible existence in taenite at its boundary with kamacite of nickel values which are considerably lower than the over-all values 31 to 54% found in six different taenites. The concentrations of gallium, germanium and copper are much greater in the taenite than in the kamacite phase. The larger proportion of cobalt, however, exists in the kamacite phase. All these elements are concentrated in their preferred phases to a degree which is higher than that observed for nickel. The relative contribution of taenite to the over-all concentrations is invariably greater than the contribution of kamacite in the case of gallium, germanium and copper, quite negligible in the case of cobalt and nearly the same as that of kamacite in the case of nickel. Correlations are observed between the nickel content of taenite, its surface inclusions of foreign phases, and the thin parallel lines which traverse the two larger surfaces of the taenite plates. (auth)

9168

THORIUM, URANIUM AND POTASSIUM IN SOME SANDSTONES. Elaine G. Murray and John A. S. Adams. Geochim. et Cosmochim. Acta 13, 260-9(1958).

Thorium, uranium, and potassium concentrations have been determined in nineteen sands and sandstones by γ-ray spectrometry, fluorometric uranium analysis, and α counting. The samples were selected so that both common and extreme thorium and uranium ratios would be represented. The average and nearly uniform values found in orthoquartzitic, clay-free sands were potassium (as metal) $0.64 \pm 0.04\%$; thorium 1.7 ± 0.1 ppm; and uranium 0.45 ± 0.05 ppm, giving a Th/U ratio of 3.8 ± 0.8. The Th/U ratio found is very near to that of average igneous rocks and may represent an independent determination of the average crustal Th/U ratio. Heavy mineral separations on some of the ordinary sands indicate that very little of the thorium, uranium, and potassium in a common sand is associated with the heavy detrital grains. Neglecting a very minor feldspar content, the radioactivity of the common sandstones studied is contained almost entirely in the quartz, where it appears to be largely related to microscopic and submicroscopic inclusions. The heavy detrital minerals do not begin to affect the Th/U ratio or concentration ratios until they occur in large quantities as in placer sands. Within experimental error, the modern beach sands studied were in radioactive equilibrium. These preliminary data provide some independent and experimental comparisons for the average thorium and uranium content of sandstones calculated from geochemical balances. The data are also helpful in constructing models of the changes in thorium and uranium ratios that might be observed in moving from a beach line through shallow water sediments to deep-water sediments. (auth)

9169

DETERMINATIONS OF THORIUM AND URANIUM IN SEDIMENTARY ROCKS BY TWO INDEPENDENT METH-

ODS. John A. S. Adams (Rice Inst. and Shell Development Co., Houston, Texas) and Jasper E. Richardson and Charles C. Templeton (Shell Development Co., Houston, Texas). Geochim. et Cosmochim. Acta 13, 270-9(1958).

Two independent methods for the determination of uranium and thorium-to-uranium ratios are described. One method is based upon γ-ray spectral analysis; the other is based upon total α-activity and fluorometric uranium determinations. Results and errors of measurements on 4 standard samples and 18 sedimentary rocks of various types are discussed. By applying both methods to the same sample, it is possible to determine if secular radioactive equilibrium exists to within experimental error. Where secular radioactive equilibrium exists in well-homogenized samples, both methods agree to within the experimental errors. The observed thorium-to-uranium ratio in sedimentary rocks ranges from less than 0.02 to more than 20; the two methods presented are capable of measuring this ratio to well within ±1 over most of this range. (auth)

9170
PHOTOGEOLOGIC MAP OF THE MOUNT ELLEN-5 QUADRANGLE, WAYNE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-250. W. R. Hemphill. Washington, U. S. Geological Survey, 1958. $0.50.

Metals and Metallurgy

Refer also to abstracts 9418, 9419, 9421, 9422, 9423, 9424, 9427, 9455, and 9556.

9171 A-2461Z(WEC)
Westinghouse Electric Corp. Aviation Gas Turbine Div., Kansas City, Mo.
DEVELOPMENT OF NIOBIUM-BASE ALLOYS. Quarterly Report No. 7. Period Covered: September 15, 1957 to January 15, 1958. R. T. Begley. Jan. 15, 1958. 52p. Contract AF33(616)-3316.

Electron-bombardment melted pure niobium was evaluated on the basis of impact transition properties and recrystallization behavior. The modulus of elasticity of niobium was determined from 25 to 400°C. Observations on the strain hardening of niobium were also made. Nb–Hf, Nb–Zr, Nb–Al, and Nb–Cr alloys were levitation melted for phase diagram studies. Niobium alloy systems were analyzed on the basis of available metallurgical data to select the most promising alloy systems with respect to weldability. Vapor pressure studies of the niobium oxides were initiated. Zone refining experiments, using the "floating zone" technique were begun. A technique for automatically sensing the zone length was worked out. (auth)

9172 AECU-3679
Atomic Power Development Associates, Inc., Detroit.
COMPILATION OF URANIUM-10 W/o MOLYBDENUM FUELS ALLOY PROPERTIES. Technical Memorandum No. 3. A. Del Grosso. June 7, 1957. 70p. $10.80(ph OTS); $3.90(mf OTS).

The mechanical and physical properties of U–10 wt. % Mo before and after irradiation have been studied. The pre-irradiation properties and some of the post-irradiation physical properties are presented in graphical and tabular form. (J.S.R.)

9173 BMI-1256
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING FEBRUARY 1958. Russell W. Dayton and Clyde R. Tipton, Jr. Mar. 1, 1958. Decl. Apr. 25, 1958. 62p. Contract W-7405-eng-92. $10.80(ph OTS); $3.90(mf OTS).

The creep properties of 15% cold-worked Zircaloy-2 are being evaluated over the 232 to 299°C temperature range. Helium density measurements were made on samples of UO_2, and the results are tabulated. Phase boundaries in the Zr–1 wt. % U alloy system were studied. Results of 168-hr corrosion testing of U–Nb and U–Mo alloys in 680°F water are given. The reaction between U and water or water vapor is being studied at temperatures ranging up to 200°C. Data are given on the hardness and fabricability of some new Nb alloys along with oxidation data for Nb and Nb alloys in dry air at 1000 to 1200°C. The ternary system uranium–nitrogen–carbon is being studied to determine the stability of solid-solution phases of uranium carbides and nitrides, and to investigate the possible existence of ternary phases. Creep data are given for tantalum during exposure to high-temperature sodium. (W.L.H.)

9174 KAPL-1874
Knolls Atomic Power Lab., Schenectady, N. Y.
EFFECT OF NEUTRON RADIATION ON NOTCHED BEND AND TENSILE PROPERTIES OF ASTM A-201A CARBON STEEL. R. L. Mehan and E. E. Baldwin. Nov. 8, 1957. 37p. Contract W-31-109-Eng-52. $1.25(OTS).

Notched bend and tensile tests were conducted on ASTM A-201 Grade A carbon steel irradiated in the Materials Testing Reactor at temperatures of 300°F ± 100 to a maximum integrated fast flux of 4.3×10^{20} nvt. Mechanical properties changed drastically; the yield strength increased to a maximum of 195% above the preirradiation value. The transition temperature increased an unknown amount, probably in excess of 400°F. It was verified that recovery of radiation-induced damage follows an equation of the form $\tau = A\, e^{-Q/RT}$ that relates the time and temperature of recovery. The results indicated that the KAPL-30 in-pile loop could be operated safely to an integrated fast flux of $\sim 4 \times 10^{20}$ nvt provided the loop received an annealing treatment of at least one hour at 600°F subsequent to each operating cycle. (auth)

9175 KAPL-A-SCM-1
Knolls Atomic Power Lab., Schenectady, N. Y.
MANUAL OF METHODS FOR CLEANING METALS. H. Suss. June 1, 1956. 112p. Contract W-31-109-Eng-52. $18.30(ph OTS); $6.00(mf OTS).

This manual has been prepared to supply data on the more popular methods used for cleaning numerous metals. A glossary of terms, bibliography, and applicable government specifications are included as supplements to the available data. The metals listed are carbon and low alloy steel, ferritic and austenitic stainless steels (AISI 300 and 400 series steels), and special alloys which include Inconel, Inconel-X, Allegheny Ludlum alloys A-286 and AM-350, 17-4 PH and 17-7 PH steels, and Haynes stellite alloys. (A.C.)

9176 LA-2190
Los Alamos Scientific Lab., N. Mex.
CHEMICAL SURFACE TREATMENTS FOR URANIUM AND THEIR APPLICATION TO URANIUM TECHNOLOGY. J. K. Gore, R. Seegmiller, J. M. Taub, A. Pinkerton, and L. Quintana. Aug. 8, 1957. 20p. Contract W-7405-eng-36. $3.30(ph OTS); $2.40(mf OTS).

Methods for cleaning, etching, and electropolishing uranium are described. Their use in preparing the metal for electroplating, mechanical fabrication, and metallurgical examination is discussed. (auth)

9177 NMI-1202
Nuclear Metals, Inc., Cambridge, Mass.
QUARTERLY PROGRESS REPORT TO THE AEC RESEARCH DIVISION FOR THE PERIOD JANUARY 1, 1958

THROUGH MARCH 31, 1958. Apr. 23, 1958. 11p. Contract AT(30-1)-1565. $3.30(ph OTS); $2.40(mf OTS).

Of the eight irradiated capsules, five with iridium and one control were opened, and the iridium separated from the receiver surfaces. Except for two defective capsules, the iridium transferred from the thimble was substantial, providing a separated activity whose ionization was easily measured. A preliminary comparison of one capsule's separated activity with that of the known iridium mass on its source thimble shows that about 6×10^{-7} g evaporated from ~23 cm^2 of surface. The effects of fast neutron irradiation on copper–iron samples show that the electrical resistivity does not behave linearly with neutron exposure or the logarithm of the neutron exposure. A specimen of arc-melted crystal bar Zr, containing five large crystals which had varied crystallographic orientations, was deformed in tension at −196°C. (For preceding period see NMI-1198.) (W.L.H.)

9178 NP-6688

General Mills, Inc., Minneapolis.

SPUTTERING YIELDS. Final Report Covering Period of May 1, 1957 to April 30, 1958. Report No. 1847. Gottfried K. Wehner. Apr. 30, 1958. 45p. Project 85033. Contract Nonr-1589(08).

Sputtering yield curves for normally incident Hg-ion bombardment in the energy region 50 to 400 ev have now been measured for the following materials: graphite, Al, Si, Ti, V, Cr, Fe, Co, Ni, Cu, Ge, Zr, Nb, Mo, Rh, Pd, Ag, Hf, Ta, W, Re, Ir, Pt, Au, Th, and U. The results show that the yield curves follow a relation: $S = K (V_i - V_o)$ where S = yield in atoms/ion, K = slope of yield curve, V_i = ion energy, and V_o = "cut in" or "threshold" energy. By plotting slopes and thresholds vs. atomic number, the following empirical relations are found: The slopes K are determined by the energy transfer factor $\eta = 4\, m_1 m_2/(m_1 + m_2)^2$ and the degree of filling of the d-shells (D) of the target atoms: $K \sim \eta \times D$. V_o on the other side seems to be mainly determined by η and the heat of sublimation H of the target material: $V_o \sim H/\eta$. These results provide further support for a general picture of sputtering which may be called "bowling or playing billiards with atoms." The collision first between the neutralized ion and a surface target atom and subsequently proceeding from atom to atom in the lattice can be treated as independent collisions between essentially hard spheres. The filling of the d-shells determines how closely the collisions approximate hard sphere collisions. Energy is most efficiently transferred in metals with completely filled d-shells like Cu, Ag, and Au. These metals consequently show the highest sputtering yields. These results agree well with theories developed by Langberg and Sillsbee, but disagree strongly with a theory published by Henschke. Sputtering yields of alloys turn out to be not substantially different from those of their main constituents. Some preliminary measurements were made on the difference in sputtering yields from different planes of a Cu and Ag single crystal and on the influence of the target temperature. Attempts to pick up atoms sputtered from the back side of a thin Au foil which is bombarded with ions at the front side were unsuccessful. (auth)

9179 SEP-244

Sylvania Electric Products Inc. Research Labs., Bayside, N. Y.

THE SELF-DIFFUSION OF NIOBIUM—I. First Annual Progress Report, January 1, 1956 to June 30, 1957. R. Resnick, L. S. Castleman, and L. Seigle. Feb. 1, 1958. 17p. Contract AT-30-1-GEN-366. $0.50(OTS).

The measurement of the self-diffusion coefficient of niobium as a function of temperature has been undertaken. It is planned to prepare the diffusion couples by the deposition of Nb^{95} onto the surfaces of niobium discs from the $Nb^{95}Cl_5$ vapor phase and to anneal the couples in the temperature range 1600° to 2000°K. Details are given of the construction of the vapor deposition apparatus and of the preparation of $Nb^{95}Cl_5$ from the oxalate form in which the isotope is received. Preliminary measurements of the diffusion coefficient in a Nb-8 wt. % Ti alloy and in a Nb-1.4 wt. % V alloy indicate that the diffusion coefficient in the former is approximately 10^{-9} cm^2/sec at 1600°C and is approximately 8×10^{-11} cm^2/sec in the latter at 1400°C. (auth)

9180 SEP-245

Sylvania Electric Products Inc. Research Labs., Bayside, N. Y.

FUNDAMENTALS OF DIFFUSIONAL BONDING—II. Second Annual Progress Report, June 30, 1956 to June 30, 1957. L. S. Castleman and L. Seigle. Feb. 15, 1958. 24p. For Sylvania-Corning Nuclear Corp. Contract AT-30-1-GEN-366.

The study of the kinetics of layer growth in the aluminum–nickel system and the effect thereon of applied pressure has been continued. Additional information has been obtained about the growth of the beta phase, and a method was developed whereby the kinetics of growth of the beta phase could be investigated. The implications of Vasileff's equations which provide the solution for interdiffusion in a three-phase two-component system have been examined semi-analytically, and quantitative insight has been gained into the kinetics of interface movement. Finally, an investigation of the kinetics of interface movement and layer growth has been begun on systems which have less complicated phase equilibrium relationships than those existing in the aluminum–nickel system. (auth)

9181 UCRL-5067

[California. Univ., Livermore. Radiation Lab.]

EXTRUSION DIE DESIGN. [A Bibliography]. Maggie Cason. Apr. 23, 1957. 14p. Contract [W-7405-eng-48]. (M-6299). $3.30(ph OTS); $2.40(mf OTS).

This is a selective bibliography of books and periodical articles relating to extrusion die design with special emphasis on extrusion of beryllium. Material on the extrusion process has been included when it contains information that might be of possible help in die designing. Sources consulted include: ASM Review of Metal Literature, 1950 to 1954; Chemical Abstracts, 1950 to 1955; Engineering Index, 1953 to 1955; Industrial Arts Index, 1950 to March 1957; Metallurgical Abstracts, 1950 to 1953; Nuclear Science Abstracts, 1950 to March 15, 1957; Physics Abstracts, 1950 to 1955; the library card catalog; and the AEC card catalog. (auth)

9182 WADC-TR-58-5(Pt. I)

National Bureau of Standards, Washington, D. C.

COATINGS OF NICKEL–ALUMINUM ALLOYS PREPARED BY ELECTROLYSIS. Period Covered: January 1957 to January 1958. Dwight E. Couch and Jean H. Connor. Feb. 15, 1958. 37p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: ELECTRODEPOSITION AND ELECTROCHEMICAL TREATMENTS. Contract AF33(616)-57-10. (AD-151078).

The electrodeposition of nickel–aluminum alloy coatings for the protection of Thermold J Alloy steel was investigated because of certain properties of the alloy, namely, extreme hardness and oxidation resistance. The alloy was formed by plating aluminum upon a layer of nickel. When the fused salt baths operated above the melting point of aluminum, the alloy was formed directly. When the aluminum was deposited at lower temperatures, the samples were later heated to form the alloy by diffusion. Oxidation

data and salt spray corrosion resistance of the alloy-plated steel are given. Optimum protection of the steel was afforded by the alloy formed at 700°C, consisting of 2 mils of nickel and 0.2 mil of aluminum. (auth)

9183 AEC-tr-3201

AMALGAM METALLURGY OF TITANIUM. (Die Amalgam-metallurgie des Titans). H. Hohn, E. Fitzer, and H. Hofbauer. Translated from Berg -u. hüttenmänn. Monatsh. montan. Hochschule Leoben 101, 277-85(1956). 26p.

Mercury as an aid in metallurgy was studied. Experiments and thermodynamic fundamentals for $TiCl_4$ reduction by amalgams and basic outlines of a technical amalgam process for production of titanium are discussed. (auth)

9184 AEC-tr-3202

REACTIONS OF COLD LIQUID AMALGAMS WITH GASES. III. TRANSFORMATIONS WITH NITROGEN MONOXIDE. (Über Reaktionen Kaltflüssiger Amalgame mit Gasen. III. Umsetzungen mit Stickstoffmonoxyd). H. Hohn, V. Gutmann, and O. Sova. Translated from Monatsh. Chem. 88, 502-16(1957). 24p.

Sodium amalgam reacts with dry nitric oxide in the vibrating mill quickly and quantitatively to sodium nitroside (NaNO). The reaction course is investigated and the separation of the reaction product is described. The cold liquid amalgams of lithium, potassium, magnesium and barium also form the corresponding nitrosides. In the case of zinc and tin, the formation of metal oxides is observed in addition which occurs exclusively in the case of iron and nickel. In contrast to the above, no transformation occurs in cadmium amalgam or in pure mercury. (auth)

9185 AEC-tr-3231

THE STRUCTURAL CHANGES IN METAL CRYSTALS AND THEIR INFLUENCE ON THE KINETICS OF HARDENING OF SOLID SOLUTIONS OF ALUMINUM. RELATION BETWEEN THE VARIATION IN MECHANICAL PROPERTIES AND THE STRUCTURE REVEALED BY OPTICAL OR ELECTRON MICROSCOPY AND BY X-RAYS. A. Berghezan. Translated by K. S. Bevis from Publs. sci. et tech. ministère air, Inst. recherches sci. et tech. Centre-Ouest, No. 283, 15-35(1953). 18p.

Results of mechanical tests show that the various speeds of quenching undergone by the alloys have differing effects on the development of their final hardness by aging or annealing. (W.L.H.)

9186

SUCCESSFUL DETERMINATION OF PHASE DIAGRAMS OF METAL SYSTEMS. Ye. O. (O. Ye.). Atomnaya Energiya 3, No. 8, 174-5(1957).

A meeting was held in Moscow from May 17 to May 21, 1957, to discuss problems connected with phase diagrams. The alloys of beryllium, niobium, zirconium, uranium, and plutonium were emphasized. (J.S.R.)

9187

ON URANIUM–ZIRCONIUM ALLOYS. G. Z. (Z. G.). Atomnaya Energiya 3, No. 8, 176-7(1957).

It was found as the result of research work recently carried out that the ϵ phase is constant up to 610°C. Between β Zr and γ U there is the eutectic reaction $\beta Zr(\gamma U) \xrightleftharpoons{593°C} \alpha Zr + \epsilon$. Above 610° the ϵ phase is decomposed: $\epsilon \xrightleftharpoons{607°C} \beta Zr + \alpha U$. An investigation of the U–Zr–O system gave the following result: the solubility of O in the ϵ phase is less than 0.05%, and in the case of a higher O content of the ϵ phase it exists together with α U and α Zr. If U is alloyed with crystalline Zr (O content 0.005%), then this alloy behaves differently than it would have done if zirconium sponge (O content 0.1%) had been used. (TCO)

9188

ON THE MECHANISM OF FRAGILIZATION OF SOLID SOLUTIONS OF ALUMINUM–ZINC AND ALUMINUM–ZINC–MAGNESIUM. Pierre Gobin and Jean Montuelle. Compt. rend. 246, 1853-5(1958) Mar. 24. (In French)

Solid solutions of Al–Zn and Al–Mg–Zn show, at room temperature and in the absence of all corrosion, a noticeable weakening of their intergranular cohesion. The mechanism of this fragilization is studied. The results indicated that the fragility in the Al–Zn alloy is caused by a condensation of lacuna at the grain seams. The addition of Mg causes a precipitation of cavities at the seams. (J.S.R.)

9189

EFFECT OF AN AXIAL COMPRESSION ON THE $\beta \rightarrow \alpha$ ALLOTROPIC TRANSFORMATION OF HIGH PURITY TITANIUM. Paul Costa and Georges Cizeron. Compt. rend. 246, 2261-3(1958) Apr. 14. (In French)

Under the effect of a weak axial compression, titanium undergoes, in the course of the $\beta \rightarrow \alpha$ transformation, a contraction of abnormal magnitude which can be explained by a mechanism of crystallization of the β system following a single privileged plane from all the possible planes (112). This phenomenon is found only in high-purity titanium. (tr-auth)

9190

HEAT RESISTANT MATERIALS FOR POWER MACHINERY BUILDING. L. A. Glikman and A. I. Chizhik. Energomashinostroyeniye 3, No. 11, 22-6(1957).

The postwar work in the Soviet Union on the development of high-temperature alloys and steels is reviewed. (J.S.R.)

9191

WHAT TO DO ABOUT POROSITY IN ALUMINUM CASTINGS. John Obrebski (Monarch Machine Tool Co., Sidney, Ohio). Iron Age 181, No. 20, 71-4(1958) May 15.

Small voids or pores due to gas bubbles are very important in terms of strength, wear resistance, or ability to contain hydraulic pressure. A detailed study of aluminum casting methods and their influence on porosity has resulted in some guiding rules for guaranteeing castings of proper density. (W.D.M.)

9192

EFFECTS OF TEMPERATURE AND RATE AND DEGREE OF DEFORMATION ON CARBON STEEL RESISTANCE TO PLASTIC DEFORMATION. Z. A. Ridnev and A. P. Chekmarev. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 12, 22-9(1957) Dec. (In Russian)

Resistance of carbon steel to plastic deformation was studied at 800 to 1200°C and 2 to 300 sec^{-1} rate of deformation. The increased rate of deformation increased the carbon steel resistance to plastic deformation while an increase in temperature had a reverse effect. At high temperatures and a relatively slow deformation rate the increased carbon content in the hypoeutectoid steel increased its resistance to plastic deformation. The increase of carbon content in the hypereutectic steel, at high temperatures and high speed of deformation, decreased its plastic deformation resistance. At 1100 to 1200° and at all deformation rates the hypereutectic steels have a lower plastic deformation resistance than the hypoeutectoid steels. (R.V.J.)

9193

EFFECTS OF PRELIMINARY DEFORMATION ON THE HEAT RESISTANCE OF ALLOYS. Yu. A. Preobrazhenskaya. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 12, 30-7(1957) Dec. (In Russian)

Studies were made of the effects of deformation on the heat resistance of the binary alloys Al–Cu, Al–Fe, Al–Mg, Al–Si, and Al–Ni. (R.V.J.)

9194

STUDIES OF THE QUATERNARY ALLOY Ni–Cr–Ti–Al. L. I. Pryashkina and L. A. Ryabtsev. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 12, 38–42(1957) Dec. (In Russian)

A schematic phase diagram is shown for the Ni–Ni_3Ti–Ni_3Al–Cr alloy at 1000°. The cross section of the Ni–Cr–Ti–Al alloy in the limited solid solution of nickel (γ) and the two phase ($\gamma + \gamma'$) was investigated for constant content of Cr (17%) and Ti (1.8%) and varying content of Al (0 to 12%). The thermal analysis showed the crystallization of the eutectic composition of the alloy at 1280° with 9% Al. The solubility of Al in the solid solution of the Ni–Cr–Ti–Al was found with 6 and 8% Al at 1200°, for nearly 6% Al at 1050°, and with 4 to 6% Al at 900°. The increase of the Al content in the quaternary solid solution of Ni (with 17 to 20% Cr and 1.8 to 2.4% Ti) sharply increased its heat resistance. The alloy with 6.40% Al was tested at 900° and 8 kg/mm^2 tension for 1000 hr and did not show disintegration even under a further test with 12 kg/mm^2 for 100 hr. (R.V.J.)

9195

SOLIDUS, SUBSOLIDUS, AND SUBDISSOCIATION PHASE EQUILIBRIA IN THE SYSTEM Fe–Al–O. L. M. Atlas and W. K. Sumida (Illinois Inst. of Tech., Chicago). J. Am. Ceram. Soc. 41, 150–60(1958) May.

The objective of this investigation was to determine phase relations in the system Fe–Al–O outside the composition and temperature regions of oxygen dissociation. Subsolidus phase equilibria were studied using inert atmospheres and the quenching technique. Compatibility relations are presented on isothermal sections at 1000, 1250, and 1350°C. Lattice parameters of iron-bearing spinel, Al_2O_3, and Fe_2O_3 are given as a function of composition. Stability and some structural relations of the compound $Fe_2O_3 \cdot Al_2O_3$ are discussed. Solidus surfaces in the nondissociating portions of the system have been established using both published data and measurements made during this investigation. (auth)

9196

HEAT CAPACITY OF SODIUM TUNGSTEN BRONZES FROM 1.8 TO 4.2°K. R. W. Vest, M. Griffel, and J. F. Smith (Iowa State Coll., Ames). J. Chem. Phys. 28, 293–6 (1958) Feb.

The heat capacity of sodium tungsten bronze (Na_xWO_3) has been measured over the temperature range 1.8 to 4.2°K for various concentrations of sodium. An approximation to the density of states curve for the conduction band was obtained from the experimental data. This may be correlated with the previously described maximum in the electrical conductivity. It was found that the lattice contribution to the heat capacity was appreciably affected by the thermal history of the sample while the electronic contribution was relatively unaffected. (auth)

9197

EQUILIBRIA BETWEEN TITANIUM METAL AND SOLUTIONS OF TITANIUM DICHLORIDE IN FUSED MAGNESIUM CHLORIDE. K. Komarek and P. Herasymenko (New York Univ.). J. Electrochem. Soc. 105, 210–15(1958) Apr.

A method has been developed for collecting vapors over solid $TiCl_2$ or over mixtures of $TiCl_2$ and $MgCl_2$ in a specially designed titanium pipette at elevated temperatures. The reaction of titanium tetra- and trichloride with Ti metal could not be prevented on cooling, but the analytical total content of chlorine could be used to determine the apparent total concentration of titanium in the vapor phase. The study indicated strong positive deviations from Raoult's Law for liquid $MgCl_2$–$TiCl_2$ solutions and limited solubility of $TiCl_2$ in liquid $MgCl_2$ in the range from 720° to 800°C. This was confirmed by thermal analyses of mixtures. The system $MgCl_2$–$TiCl_2$ is of the peritectic type. The peritectic point lies at about 0.3 wt. % $TiCl_2$ and at 716°C. The melting point of $TiCl_2$ is 1025°C. Salt mixtures in equilibrium with Ti metal contain only $TiCl_2$, and no measurable quantities of $TiCl_4$ or $TiCl_3$. (auth)

9198

EQUILIBRIA BETWEEN TITANIUM METAL AND SOLUTIONS OF TITANIUM DICHLORIDE IN FUSED SODIUM CHLORIDE. K. Komarek and P. Herasymenko (New York Univ.). J. Electrochem. Soc. 105, 216–19(1958) Apr.

Thermal analyses of $TiCl_2$ and NaCl in closed titanium metal crucibles were made in the range from 0 to 100 wt.% $TiCl_2$. The melting point of $TiCl_2$ was confirmed to be 1025°C. The phase diagram of the system has two compounds and one eutectic. The eutectic point lies at 50.0 wt. % $TiCl_2$ and 605°C. One compound, $NaCl \cdot TiCl_2$, is formed by a peritectic reaction at 628°C; the other one, $2NaCl \cdot TiCl_2$, decomposes in the solid state at 548°C. The free energy curves derived from the phase diagram indicate that liquid NaCl–$TiCl_2$ melts have the highest stability at temperatures up to about 800°C at the composition 2Na + 1 Ti + 4Cl, thus making probable the existence of $[TiCl_4]^{2-}$ complex ions. At higher temperatures or in the presence of large cations, more complex ionic clusters are likely to exist. (auth)

9199

EQUILIBRIA IN THE NIOBIUM-HYDROGEN SYSTEM. W. M. Albrecht, M. W. Mallet, and W. D. Goode (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 105, 219–23(1958) Apr.

Equilibria in the niobium–hydrogen system were determined in the range 100° to 900°C, 10 to 1000 mm of mercury hydrogen pressure, and atomic ratios of hydrogen to niobium of 0.01 to 0.85. A single phase solid solution of hydrogen in niobium was produced throughout most of the system. In no region did the equilibrium solubility exactly follow a simple pressure dependency. The heat of solution increased with hydrogen content, which behavior may be related to an expansion in the niobium lattice. (auth)

9200

THE STRUCTURE AND MECHANICAL PROPERTIES OF HIGH-PURITY ALUMINIUM–ZINC–MAGNESIUM ALLOYS. P. C. Varley, M. K. B. Day, and A. Sendorek (British Aluminium Co., Ltd., Gerrards Cross, Bucks, Eng.). J. Inst. Metals 86, 337–51(1958) Apr.

Super-purity-base alloys of aluminum, zinc, and magnesium, when quenched from 465°C and naturally aged, showed a steady improvement in mechanical properties with a decrease in ductility as the alloying content and the time of aging were raised, the fractures becoming increasingly intercrystalline and brittle. With a standard artificial aging treatment of 16 hr at 135°C, there was again a steady rise in tensile strength and proof stress with increasing alloying additions, and a maximum was reached with 9% addition. Above this, the alloys were brittle and the proof stress could not be determined. Electron micrographs showed that this intercrystalline weakness was associated with the development of mechanically weak, denuded zones along the grain boundaries, as a result of preferential grain-boundary precipitation. (auth)

9201

NOTE ON THE INFLUENCE OF SODIUM ON MAGNESIUM–LITHIUM ALLOYS. R. J. M. Payne and J. D. L. Eynon (J. Stone and Co. (Charlton), Ltd., London). J. Inst. Metals 86, 351–2(1958) Apr.

The solubility of sodium in magnesium–lithium alloys is

shown to vary with temperature. As a result, alloys containing sodium may become embrittled on standing at ordinary temperatures or during certain heat-treatment processes. To avoid these effects, sodium contents must be held to low levels. The tolerance for sodium depends on grain size; for a cast binary magnesium–12% lithium alloy it is in the region of 0.002%. (auth)

9202

THE CONTROL OF EARING IN ALUMINIUM AND ITS ALLOYS. R. T. Thorley (High Duty Alloys, Ltd., Slough, Bucks, Eng.) and G. E. G. Tucker (Aluminium Labs., Ltd., Banbury, Oxon, Eng.). J. Inst. Metals 86, 353-61(1958) Apr.

The problem of earing in aluminum and its alloys is of considerable importance to fabricators and consumers because of the detrimental effect of ears on the quality of deep-drawn products, and it is desirable that earing should be eliminated or reduced to a very low level in the materials most commonly used for deep drawing. These are super-purity and commercial-purity aluminum and aluminum–manganese, aluminum–magnesium, and aluminum–magnesium–silicon alloys. The earing of aluminum and its alloys is affected by variations in fabricating technique, and it is the purpose of the present paper to describe the conclusions drawn from work at Aluminium Laboratories Limited and the Northern Aluminium Co., Ltd., on the way in which these variations affect earing, so that suitable adjustments may be made to reduce earing to a satisfactory level in any particular plant. The earing of sheet produced in the normal manner (i.e. by homogenizing the ingot, hot rolling, cold rolling, and final annealing) has been found to vary according to the finish thickness. The shape of the curve of earing plotted against finish thickness is dependent upon the fabricating conditions, and this curve has been used to show the effects of alloy type and composition, preheating, hot rolling, interannealing, and cold rolling. (auth)

9203

A NEW INVESTIGATION OF ANOMALIES IN CHROMIUM. H. Pursey (National Physical Lab., Teddington, Middlesex, Eng.). J. Inst. Metals 86, 362-8(1958) Apr.

An account is given of elasticity measurements made on samples of pure and impure chromium from −200° to +150°C. The presence of certain impurities, notably silicon and iron, tends to depress the temperature of the anomaly reported by previous investigators, and also greatly increases its magnitude. The elastic anomaly is interpreted as a change in volume of the material at a certain temperature, which is a function of the stress on the material. Hence, if the temperature of a specimen is fixed and the stress varied, an anomalous expansion or contraction occurs as the material changes from its modified to its unmodified form. This interpretation accounts for the negative Poisson's ratio observed on some samples in the present investigation, and also agrees quantitatively with measurements of the anomaly in thermal expansion and with Bridgman's work on the effect of pressure on the temperature of the anomaly. Finally, the existence of a possible connection between these anomalies and an antiferromagnetic → disorder transition is briefly discussed. (auth)

9204

THE DETERMINATION OF THE SOLUBILITIES OF BERYLLIUM AND MOLYBDENUM IN LIQUID BISMUTH. G. W. Horsley and J. T. Maskrey (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inst. Metals 86, 401-2(1958) Apr.

The solubility of beryllium in bismuth has been determined in the range 700 to 1000°C, and its variation with temperature may be represented by the equation: $\log_{10}S = 6.85 - 6140/T$, where S is the solubility in ppm and T is the absolute temperature. The solubility of molybdenum in bismuth is below the limits of analytical detection (1 ppm) up to 1030°C. (auth)

9205

COMING: BETTER THERMENOL ALLOYS. W. J. Buehler and C. G. Dalrymple (U. S. Naval Ordnance Lab., Silver Spring, Md.). Metal Progr. 73, No. 5, 78-81(1958) May.

Iron–aluminum alloys with 3 to 4% molybdenum have excellent oxidation resistance and stress-rupture strength. The alloys are useful for high-temperature applications with small additions of zirconium and carbon to raise the mechanical properties and inhibit grain growth. The preparation and some properties are discussed. (J.E.D.)

9206

HOW TO CAN URANIUM FUEL. S. S. Smith and L. R. Hawtin (Imperial Chemical Industries, Ltd.). New Scientist 3, No. 75, 28-31(1958) Apr. 24.

The history of fuel canning in Britain is traced, and some of the more important types of fuel elements are pictured. (M.H.R.)

9207

NIOBIUM AND ITS ALLOYS. C. R. Tottle (U.K.A.E.A., Dounreay Experimental Establishment). Nuclear Eng. 3, 212-16(1958) May.

Niobium has much to offer in the field of liquid-cooled reactors not involving oxidizing conditions, particularly where high temperatures are involved. The extraction process is tedious, but manufacture is comparatively free from severe troubles arising from peculiar properties. The production and fabrication of the metal and its alloys will always be expensive owing to the necessity for protection from atmospheric attack during sintering, melting, heat treatment, and joining. Future development should simplify techniques and improve the properties in such a way that the cost is justified by the behavior in service. Tables of all the available properties of niobium are presented. (W.D.M.)

9208

NUCLEAR POWER WELDING SYMPOSIUM. Nuclear Power 3, 206-28(1958) May.

A survey of the special problems of welding in nuclear energy plants and the techniques used is presented. The method of fabricating reactor pressure vessels and heat exchangers is described. The welding of aluminum and its alloys, magnesium and its alloys, uranium, beryllium, zirconium, and niobium is discussed in detail, and problems relating to each are described. The fabrication of corrosion and heat resisting steels is analyzed. A section is presented on non-destructive weld testing methods used in routine operations on nuclear power plants. (W.D.M.)

9209

FISSION GAS BEHAVIOR IN THE URANIUM–ALUMINUM SYSTEM. Myron B. Reynolds (General Electric Co., Schenectady, N. Y.). Nuclear Sci. and Eng. 3, 428-34(1958) Apr.

Data on the diffusion of fission krypton from irradiated 20 weight per cent uranium–aluminum alloy are presented. At temperatures below 640°C (the eutectic) there was no measurable loss of radiokrypton from this alloy during annealing periods of up to three weeks. At temperatures above the eutectic gas evolution occurred with a time dependence in rough agreement with the theoretical prediction for diffusion from spherical particles. The nature of the diffusion process for rare gases in metallic systems is discussed with particular reference to the limitations imposed on diffusion rate by solubility and available concentration gradient. The basic difference between the be-

havior of fission gases in dispersion-type nuclear fuels and in homogeneous solid-type fuels is outlined. The data on the uranium–aluminum alloy system are interpreted in light of this discussion. (auth)

9210

THE THERMAL CONDUCTIVITY OF TIN–INDIUM ALLOYS IN THE NORMAL STATE. C. A. Shiffman (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) 71, 597-607(1958) Apr.

Measurements have been made of the thermal conductivity in the normal state of ten alloys of tin with from two to eight per cent indium, over the range from 2 to 20°K. The samples with less than 3% indium satisfy the relation $W = \rho_0/L_0T + \alpha T^2$ except at the lowest temperatures where a small lattice term lowers the thermal resistance. The more impure samples show a large lattice conductivity over the entire range. This is roughly parabolic below 4°K but is linear in T from 5 to 16 or 17°K. The linear dependence is ascribed to scattering of phonons either by the local disorder in the lattice at the boundaries of mosaic domains or by stacking faults. (auth)

9211

COMPARISON OF SEMI-EMPIRICAL SOLUTIONS FOR CRACK PROPAGATION WITH EXPERIMENTS. J. Frisch (Univ. of California, Berkeley). Trans. Am. Soc. Mech. Engrs. 80, 921-8(1958) May.

The crack-propagation characteristics of two aluminum alloys and several steels were investigated in sheet materials under uniaxial tension. Empirical formulas based on ultimate strength and initial crack length were found to be a sufficiently effective method for establishing the relative merit of a material in its resistance to crack propagation. Comparison of experimental data with criteria obtained from the energy-release rate or stress-concentration theory shows that neither method yields reliable material constants. (auth)

9212

ANALYSIS OF RESIDUAL STRESS IN GROUND SURFACES OF HIGH-TEMPERATURE ALLOYS. R. D. Halverstadt (General Electric Co., Cincinnati). Trans. Am. Soc. Mech. Engrs. 80, 929-40(1958) May.

Residual stress caused by grinding high-temperature alloys has proved to be a troublesome problem both from a standpoint of distortion of the parts and from reduced endurance limits. A complete analysis was made which measured the effect of grinding-wheel speed, grinding-wheel hardness, grinding fluid, down feed, and work speed on the residual-stress level in the surface of three alloys used in modern aircraft gas-turbine design. The results of the study show that stresses can be minimized by using lower wheel speeds and down feeds, increasing work speed and using a sulfurized oil as the grinding fluid. (auth)

9213

THERMODYNAMIC STUDY OF LIQUID Pb–Zn SOLUTIONS. F. D. Rosenthal and G. J. Mills (California Inst. of Tech., Pasadena) and F. J. Dunkerley (Rolle Mfg. Co., Lansdale, Penna.). Trans. Met. Soc. AIME 212, 153-61(1958) Apr.

Activities, free energies, and heats and entropies of mixing of liquid Pb–Zn alloys have been obtained by the electrode-potential method between 400 and 650°C. The large positive deviations observed from Raoult's law are in agreement with the phase diagram, which indicates a wide immiscibility field. A vapor-pressure method was used to extend the activity measurements to 900°C, allowing the maximum of the immiscibility gap to be estimated by thermodynamic calculation. Data on the monotectic and eutectic points compare favorably with previously existing work. (auth)

9214

THEORY OF BRITTLE FRACTURE IN STEEL AND SIMILAR METALS. A. H. Cottrell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Met. Soc. AIME 212, 192-203(1958) Apr.

Most of our knowledge about brittleness in metals has come from studies of structural steel, and it is this material that is mainly considered in this study. A discussion is presented on fracture and plastic deformation. It appears that brittle fracture in steel, and perhaps in most other metals, is started by plastic deformation. A discussion of experimental studies of yield point is included, and data showing a linear relationship between grain size and stress are graphically presented. Small aluminum additions refine the grain size and reduce the brittleness. The effect of alloying steel with manganese and also with chromium is discussed. (A.C.)

9215

THE AIR MELTING OF IRON–ALUMINUM ALLOYS. V. F. Zackay and W. A. Goering (Ford Motor Co., Dearborn Mich.). Trans. Met. Soc. AIME 212, 203-4(1958) Apr.

Low-carbon Fe is induction melted without a slag in a rammed magnesia crucible. At the beginning of melt-down, Al pig (99.95% Al) charged in a clay-graphite bottom-pouring crucible is placed in a pot furnace at 1800°F. The primary deoxidation of the molten Fe after melt-down is effected by the addition of 0.1% Al and 0.5% Mn. A more drastic deoxidation designed to reduce the O_2 content to the lowest possible level is accomplished by plunging metallic Ca to the bottom of the melt. The aluminum, which has been removed from the holding furnace, is then H_2 degassed by bubbling Cl_2 through a quartz tube immersed in the molten Al. About 0.1% Ca is then added to the Al, the oxide dross is removed, fluorspor is added to the molten Fe, and the molten Al is poured through the fluorspar slag. After vigorous stirring, the melt is poured into cast-iron molds. Ingots are removed from the molds and buried in vermiculite, where they are allowed to cool to room temperature. The ingots are radiographed, cropped, and heated to 1800°F for breakdown. The ingot is then rolled. (A.C.)

9216

HYDROGEN SOLUBILITY AND REMOVAL FOR TITANIUM AND TITANIUM ALLOYS. W. M. Albrecht and M. W. Mallett (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 212, 204-10(1958) Apr.

The solubilities of hydrogen in titanium and several of its alloys were determined at 600 to 1000°C and pressures of 0.05 to 10μ of mercury. Solubility increases with increasing beta phase in the alloys. Factors found to affect degassing rates are specimen size and presence of thick surficial oxide. Removal of hydrogen by heating in vacuum and in flowing inert atmospheres was studied. Practical curves predicting minimum degassing times are presented. (auth)

9217

FURTHER EVIDENCE OF ZONING IN A NICKEL–CHROMIUM–TITANIUM–ALUMINUM ALLOY. N. E. Rogen and N. J. Grant (Massachusetts Inst. of Tech., Cambridge). Trans. Met. Soc. AIME, 218-19(1958) Apr.

This investigation was undertaken to establish whether atomic arrangements ("zoning") occur in the supersaturated solid solution prior to the actual precipitation of the γ'-phase. Any zoning reaction would involve the redistribution of many atoms. An alloy of aluminum–chromium–nickel–titanium was studied. By measuring the lattice parameter of the matrix with time and temperature, any existing zoning reaction could be observed. (A.C.)

9218

PHASE TRANSFORMATIONS IN TITANIUM-RICH ALLOYS

OF TITANIUM AND COBALT. P. R. Swann and J. G. Parr (Univ. of Alberta, Edmondton, Can.). Trans. Met. Soc. AIME 212, 276-9(1958) Apr.

Quenched structures were studied in alloys containing up to 12.5% cobalt. The subsequent decomposition of a 10% cobalt retained-β phase alloy was investigated using metallographic and x-ray-diffraction methods. Hardness measurements also were made during the decomposition process. Precipitation of Ti_2Co is by nucleation and growth; and an activation energy of 50,000 cal per mole was determined. The values of the coefficient n suggest that the precipitate is pearlitic at temperatures between 450 and 475°C, and spheroidal between 500 and 525°C. (auth)

9219

ELECTRON MICROGRAPHIC STUDY OF AGING IN A BETA TITANIUM ALLOY. F. C. Holden and A. P. Young (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 212, 287-8(1958) Apr.

It has been shown by Frost and co-workers that the increased hardness in titanium alloys is caused by the formation of a metastable phase, omega, which can be identified from its x-ray-diffraction pattern. The x-ray-diffraction analysis by Austin and Doig indicated that omega is low in alloy content, approaching the composition of the stable alpha. The aging process proceeds by the path $\beta \rightarrow \beta + \omega \rightarrow \beta + \omega + \alpha \rightarrow \beta + \alpha$. Thus over-aging results in the formation of alpha and the ultimate disappearance of ω. This is accompanied by a decrease in hardness and a recovery of ductility. (A.C.)

9220

FUSION WELDING OF TITANIUM IN JET-ENGINE APPLICATIONS. H. W. Hoefer (Orenda Engines, Ltd., Toronto, Ont., Can.). Welding J. (N. Y.) 37, 467-77(1958) May.

The high chemical activity inherent in titanium imposes severe limitations on the choice of suitable welding processes. At elevated temperatures, titanium readily reacts with active elements and compounds, many of which contribute to embrittlement of the metal. During welding the metal affected by welding heat must be protected by a medium that is free of these active elements. Flame- and arc-welding processes involving coatings, fluxes, and active gases are not satisfactory for welding titanium, and virtually all titanium fusion welds must be made by the inert-gas tungsten-arc process. (W.D.M.)

9221

CRACKING ASSOCIATED WITH POROSITY IN TITANIUM WELDS OVER 0.125 IN. THICK. R. P. Olsen and J. Gates (North American Aviation, Inc., Los Angeles). Welding J. (N. Y.) 37, 478-83(1958) May.

Since a microcrack not revealed by x rays was found, it was concluded that normal x ray inspection was not valid in the case of large rigid titanium weldments. It is believed that the cracking was caused by the rigidity of the sheets being welded and by microembrittlement not distinguishable by normal physical or chemical testing methods. It appears that the inert-gas metal-arc process will produce crack-free welds under the same conditions where the inert-gas tungsten-arc welds will not. This is based on the experimental information reported. (W.D.M.)

9222

A STUDY OF FACTORS AFFECTING THE STRENGTH AND DUCTILITY OF WELD METAL. C. M. Wayman (Univ. of Illinois, Urbana) and R. D. Stout (Lehigh Univ., Bethelehem, Penna.). Welding J. (N. Y.) 37, 193s-200s(1958) May.

The purpose of this investigation was to study the factors responsible for the strength and ductility of arc-weld metals in unalloyed carbon steel. An explanation was sought for the high level of strength and high yield ratio attendant with a comparatively mild chemical composition. Different welding procedures, welding variables, and metallurgical variables such as heat treatment and chemical composition were studied. (W.D.M.)

9223

CHARPY BRITTLE-FRACTURE TRANSITIONS BY THE LATERAL EXPANSION-ENERGY RELATIONSHIP. George M. Orner (Watertown Arsenal, Mass.). Welding J. (N. Y.) 37, 201s-5s(1958) May.

Earlier reports have introduced a method for separating the crack-initiation and crack-propagation stages of fracture in the Charpy impact test. The technique requires initiation of a crack by means of a low-energy blow and propagation of the crack by a full-capacity blow of the impact-machine pendulum. A definition of transition temperature has been proposed which is considered to be of fundamental significance, viz., the maximum temperature at which a self-propagating crack can initiate in a cross section of infinite dimensions. A discontinuity in the plot of energy-to-fracture versus lateral expansion is shown to exist which correlates quantitatively with the low-blow transition temperature, and thereby provides further evidence of the fundamental nature of the low-blow transition. Moreover, certain apparently anomalous effects are attributed to adiabatic temperature rise which in conventional (single-blow) impact testing can produce fictitiously low-transition curves, particularly in sub-size of keyhole-Charpy impact specimens. (auth)

9224

COOLING RATES AND PEAK TEMPERATURES IN FUSION WELDING. Clyde M. Adams, Jr. (Massachusetts Inst. of Tech., Cambridge). Welding J. (N. Y.) 37, 210s-15s(1958) May.

It has been found possible to derive relationships giving peak temperatures and cooling (or heating) rates directly as functions of geometric, thermal and welding variables. The expressions are close approximations, derived from the published temperature equations, demonstrably accurate to within 5%, and are simple enough to be of engineering usefulness. The most significant feature of the simplified equations is the clarity with which effects of changes in any welding, thermal or geometric variables can be predicted. Many results depend on whether the object being welded behaves like a thin sheet (two-dimensional heat flow) or a thick plate (three-dimensional heat flow), and this is readily determined. (auth)

9225

HIGH-TEMPERATURE VACUUM BRAZING OF JET-ENGINE MATERIALS. E. G. Huschke, Jr. and G. S. Hoppin III (General Electric Co., Cincinnati). Welding J. (N. Y.). 37, 233s-40s(1958) May.

Pressures in the range 2 to 35 microns were found necessary for vacuum brazing of three representative titanium- and aluminum-bearing superalloys. The gas evolution per unit weight of base metals of this class and of powdered BNiCr brazing alloys was found to vary greatly with melting practice and weight/surface area. Results of sample calculations showing the interrelationship between gas evolution during brazing and vacuum pumping capacity are presented. Four special techniques for hydrogen brazing the titanium- and aluminum-bearing superalloys were found effective, with certain limitations. Strengths of vacuum and hydrogen brazed joints of an alloy easily brazed in hydrogen (L-605) were found equal, while the special techniques necessary to braze a titanium- and aluminum-bearing alloy (R-235) in hydrogen resulted in lower joint strengths than were achieved by vacuum brazing. (auth)

PHYSICS

9226 AECD-4027
Oak Ridge National Lab., Tenn.
PHYSICS OF SOLIDS INSTITUTE QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 31, 1951. D. S. Billington and J. T. Howe, eds. July 17, 1951. Decl. with deletions Jan. 12, 1956. 51p. Contract W-7405-eng-26. $9.30(ph OTS); $3.60(mf OTS).

Solid-State Reactions. A pile-loading facility for the X-10 reactor is described. Experiments indicate that for pile exposures up to 15 days the resistance of Cu_2O increases monotonically and approaches a high saturation value. Bombardment of Cu_2O rectifiers has been continued. Investigations were made into the temperature dependence of rate of conductivity change for p-type germanium under bombardment. Fast neutron fluxes relative to center pile measurements were determined for hole 51 using n-type germanium plates. Two attempts were made to irradiate lithium in iron capsules using the Berkeley 60-in. cyclotron. Crystal Physics. A study was made of property changes of single crystals of Cu under irradiation. Tensile tests, electrical resistivity, and density comparisons were made between irradiated and unirradiated identical crystals. Copper samples were bombarded with protons in the Y-12 86 in. cyclotron, and effect on hardness was noted. Light-transmission characteristics of high-density glass were measured after various time exposures to a Co^{60} gamma source. Remote-control equipment for use in hot cells is described. Radiation Metallurgy. Investigations were conducted on the radiation hardening of copper alloys. Stress-strain curves were run on samples containing bonded strain gages both before and after irradiation. Engineering Properties. A study was made of changes in density, electrical resistance, and dimensions caused by exposure of Be in a reactor. (W.L.H.)

9227 NYO-7923
Aeroprojects, Inc., West Chester, Penna.
PRELIMINARY STUDY OF ULTRASONIC DESCALING. 14p. Contract AT(30-1)-1836. $3.30(ph OTS); $2.40(mf OTS).

In the chemical processing of HRT core solution, scale containing traces of corrosion products results from thermal precipitation of rare earth fission compounds. The almost prohibitive cost of remote maintenance has generated an interest in the feasibility of ultrasonic descaling, the vibratory energy being introduced from transducers located outside radiation fields. In a preliminary feasibility investigation, ultrasonics was applied to a representative section of HRT heater pipe in a flexural vibratory mode. Although some descaling was observed, satisfactory vibration of the pipe in this mode would require more power than appeared practicable. Attempts to introduce effective radial vibration into a simulated pipe section indicated successful descaling would require considerable study of the limitations of ultrasonic power and frequency and of heater tube size. Two possible approaches to radial vibration of a heater pipe are suggested, but the geometric restrictions imposed by the size and configuration of the heater pipe presently utilized in the HRT Chemical Process Plant and the present state of ultrasonic cleaning technology suggest that use of ultrasonic descaling be deferred until larger tube sizes are utilized. (auth)

9228 SC-4139(TR)
Sandia Corp., Albuquerque, N. Mex.
STABILITY OF AN AERODYNAMIC BODY WITH A ROTOR. F. G. Blottner. Dec. 1957. 26p. Contract [AT(29-1)-789]. $0.75(OTS).

The stability of an aerodynamic body with a rotor is investigated for the following conditions: pitching and yawing of a nonrolling body with balanced rotor; pitching and yawing of a nonrolling body with unbalanced rotor; and pitching and yawing of a steadily rolling body with balanced rotor. The aerodynamic body with a rotor is stable provided that the viscous damping and spring constant for the system are positive and that the ratio of the moment of inertia of the rotor about its rotational axis to the moment of inertia of the body with rotor about its pitch or yaw axis is less than approximately 0.90. (auth)

9229 SCTM-51-58(14)
Sandia Corp., Albuquerque, N. Mex.
RADIATION FROM AN INVERTED L-ANTENNA WITH IMAGE. C. W. Harrison, Jr. and Dale Sparks. Apr. 16, 1958. 16p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

The far zone electric and magnetic fields of an inverted L-antenna with image are calculated on the basis of an assumed sinusoidal distribution of current in the structure. The field pattern thus determined corresponds closely to the distant field of any antenna that may be synthesized from an inverted L-antenna with image and a transmission line section. This is true because the radiation field is due principally to antenna mode rather than transmission line mode currents. An antenna-transmission line configuration of the type included within the purview of this analysis is the familiar 'hairpin' (or bent folded unipole) telemetry antenna. (auth)

9230 AEC-tr-2715
TEMPERATURE DEPENDENCE OF PLASTICITY AND TENSILE STRENGTH OF ROCK SALT CRYSTALS. (Temperaturabhängigkeit der Plastizität und Zugfestigkeit von Steinsalzkristallen.) Walter Theile. Translated from Z. Physik 75, 763-76(1932). 18p.

Using four different types of rock salt, the plastic stress-strain curves for small plasticities as well as the tensile strength are determined from room temperature up to 600°C for tension perpendicular to the plane of the cube. Deformation and solidification are not of a thermal nature; they are favored in the investigated temperature range by an increase of temperature. The maximum solidification obtained at 600°C amounts to 1000 times the stress at the beginning of plasticity; the tensile strength of about 10,000 g/mm^2 corresponds to the strengths obtained with rock salt stripped under load at room temperature (7000 to 12,000 g/mm^2) and approaches an order of magnitude up to the theoretical lattice strength of 200,000 to 400,000 g/mm^2. (auth)

9231 SCL-T-182
PARTICLE SIZE DISTRIBUTION OF PHOSPHORESCENT SUBSTANCES AND THEIR AGGREGATES IN SOLUTION. S. Hionoya and T. Ishakawa. Translated from J. Chem. Soc. Japan, Ind. Chem. Sect. 57, 89-90(1954). 8p.

Fluorescent bodies of the zinc sulfide family were investigated by microscopic measurement of particle size distribution. The materials used were ZnCdS(Ag), ZnS(Ag), and ZnCdS(Ag). These were deposited on x-ray screens and television tubes, glazed, and washed. The particle diameter was measured by microfilming. Particle size distribution curves as a function of weight were drawn. (J.S.R.)

9232 T-77(RAND)
TWO RUSSIAN ARTICLES ON THE BALLISTIC MISSILE. Herbert S. Dinerstein. Includes translations: HOW THE GUIDANCE OF THE INTERCONTINENTAL BALLISTIC MISSILE IS CARRIED OUT: AN INTERVIEW WITH DOCTOR OF TECHNICAL SCIENCES, COMRADE I. E.

KAZAKOV. Sovetskaya aviatsiya (1957) Aug. 31; and THE DEVELOPMENT OF ROCKET TECHNOLOGY. V. A. Semenov. Sovetskaya rossiya (1957) Sept. 14. 11p.

Translations of two recent articles from the Soviet press give a figure for the maximum error from target of ballistic missiles. Semenov puts it at 6.2 to 7.4 miles for an intercontinental range, whereas Kazakov gives a figure of 0.002 parts of the distance traversed. (W.D.M.)

9233

A SPARK SOURCE OF MULTIPLE-CHARGED IONS. A. A. Plyutto, D. N. Kervalidze, and I. F. Kvartskhava. Atomnaya Energiya 3, No. 8, 153-6(1957).

By means of a spark source, which is described in detail, it is possible to obtain multiply charged ion fluxes of high intensity. As a current source for the formation of the spark a condenser with 10^3 to 10^5 mf, 10 to 70 kv, average spark current 10^2 to 10^4 amp was used. The ions were analyzed by means of a Thompson parabola mass spectrograph. The ion currents (not focused) obtained are tabulated. (TCO)

9234

IMAGE FORMATION OF A HIGH TEMPERATURE VACUUM EVAPORATION SOURCE THROUGH COMBINED DISTILLATION CAMERA EXPOSURES AND AUTORADIOGRAPHY WITH Au^{198}, Cr^{51}, AND W^{185}. Luther E. Preuss (Edsel B. Ford Inst. for Medical Research, Detroit). Intern. J. Appl. Radiation and Isotopes 3, 143-55(1958).

A combination of vacuum distillation self-imaging and autoradiography is described for the production of an image of the vacuum evaporation geometry of an evaporating source at the instant of molecular distillation, or during selected periods throughout the distilling sequence. The mode of the macrodistillation phenomena may be ascertained by the method, which is particularly applicable to the study of distillation phenomena of minute masses of charge material. The system provides an image, the density of which quantitatively represents the intensity of the evaporation rate from any point on the distillation source. A shutter system may be used to provide discrete images of the distillation phenomena at limited, selected time periods throughout the evaporation. The method consists first of the use of a simple vacuum distillation camera. The image of the source being formed on a cold target plate at the image plane and made up of the condensed metal distilland, tagged with its radioactive isotope. Single isotopes or combinations of the tagged metals may be used in the crucible and charge. Radioisotopes used here are Au^{198}, Cr^{51}, and W^{185}. The metallic condensed metal in image array may be so tenuous as to be invisible on this target plate. This condensed tagged metal is placed in gross apposition with a proper autoradiographic emulsion and the resultant photographic negative presents the true image of the distillation intensities at the source. This image may not necessarily coincide with the geometric, mechanical limits of the filament plus charge. The autoradiographic image reproduces the apparent source seen by the target. This special benefit of the method, in that it demonstrates the source region from which the distilling atoms emanate, allows study of wetting phenomena, creep of charge, reflection and distilland scattering phenomena. Image photographic density may be a quantitative measure of the source distillation rate, when the photographic process is standardized. The method has potential in binary isotope distillations to determine simultaneous evaporation phenomena of charge and crucible. The method's resolution theoretically extends to the order of 10 μ and has a sensitivity down to 500 μg charge mass distilled. Source images may consist of as little as 10^{-10}g of metal for certain beta emitters. (auth)

9235

PULSED HIGH-INTENSITY ION SOURCE. PART I. Jan Flinta (A. B. Atomenergi, Stockholm). Nuclear Instr. 2, 219-26(1958) Apr.

The limitations of the discharge current, extraction of ions, and focusing of large ion current beams are reported. Three types of ion sources are described and their data given. (auth)

9236

PULSED HIGH-INTENSITY ION SOURCE. PART II. Rolf Pauli and Jan Flinta (A. B. Atomenergi, Stockholm). Nuclear Instr. 2, 227-36(1958) Apr.

A detailed investigation was made of the characteristics of the discharge of the Penning type. For this purpose a special ion source was built which allowed for the exchange of all inner parts. (auth)

9237

FAR TRANSMISSION OF AIR BLAST WAVES. Everett F. Cox (Sandia Corp., Albuquerque, N. Mex.). Phys. Fluids 1, 95-101(1958) Mar.-Apr.

A semiacoustic theory of blast energy propagation, incorporating Sachs' scaling modified for altitude of observation, gives excellent agreement with experiments, providing Hilliar's similarity principle is restricted to similar ambient (weather) conditions. Comparisons between this theory and experiments are made for free air (no reflections) blast pressures; ground-level blast pressures in an isothermal, still atmosphere; and blast pressures under a linear temperature inversion. (auth)

9238

THE ELECTRICAL CONDUCTIVITY AND THERMOELECTRIC POWER OF BISMUTH TELLURIDE. H. J. Goldsmid (General Electric Co., Ltd., Wembley, Middx., Eng.). Proc. Phys. Soc. (London) 71, 633-46(1958) Apr.

The electrical conductivity and thermoelectric power of the semiconductor Bi_2Te_3 have been measured between 150 and 300°K. n-type and p-type samples with a wide range of carrier concentration have been included. Most samples have shown extrinsic conduction and have been partially degenerate over at least part of the temperature range, so it has been necessary to use Fermi–Dirac statistics in interpreting the results. A few samples have exhibited mixed and intrinsic conduction at the higher temperatures. It has been possible to determine the variation of carrier mobility with temperature and to estimate the energy dependence of the relaxation time, as well as a number of the semiconductor parameters. (auth)

9239

PROPERTIES OF p-TYPE INDIUM ANTIMONIDE: I. ELECTRICAL PROPERTIES. C. Hilsum and R. Barrie (Services Electronics Research Lab., Baldock, Herts., Eng.). Proc. Phys. Soc. (London) 71, 676-85(1958) Apr.

The dependence of electron and hole mobilities on carrier concentration has been determined for p-type indium antimonide with impurity concentrations ranging from 10^{14} to 2×10^{17} cm^{-3}. The method used was the analysis of the variation of Hall coefficient and resistivity with a magnetic field. Good agreement was obtained with a simple theory, which assumes that the carrier relaxation time is independent of energy. The decrease of electron mobility with acceptor concentration can be explained by assuming that in pure indium antimonide the important scattering mechanisms are polar scattering and electron–hole scattering. (auth)

9240

THE FERMI LEVEL IN GERMANIUM AT HIGH TEMPERATURES. J. S. Blakemore (Honeywell Research Center, Hopkins, Minn.). Proc. Phys. Soc. (London) 71, 692-4(1958) Apr.

Some results are given of calculations on the Fermi level in doped and intrinsic germanium from room temperature to the melting point (~1200°K). Results of calculations are graphically summarized. (A.C.)

9241

ON THE MASS-ACTION LAWS IN DEGENERATE SEMICONDUCTORS. F. W. G. Rose (British Thomson-Houston Co. Ltd., Rugby, Eng.). Proc. Phys. Soc. (London) 71, 699-701(1958) Apr.

In a recent research note (Rose 1957) the mass-action laws for the reactions between free carriers and impurities in semiconductors were derived; however, it was difficult to interpret the results in the degenerate case because the effective density of the energy levels in the conduction band and valence band, respectively, was not well defined. In this paper it is shown that these densities are defined. A classical discussion is presented, and the results of calculations are summarized graphically. (A.C.)

9242

REDUCTION OF MAGNETIC SUSCEPTIBILITY IN BERYLLIUM–COPPER. Harold Bernstein (Naval Gun Factory, Washington). Trans. Met. Soc. AIME 212, 225-6(1958) Apr.

This investigation was carried out to establish the effect of small amounts of iron on the susceptibility of the material and to determine if the effect could be minimized. Graphical study of experimental data indicates that the volume susceptibility of beryllium–copper can be reduced from over 100×10^{-5} e.m.u.c.g.s. to less than 2×10^{-5} by raising the solution temperature 100°F. The susceptibility-temperature curve shows that the alloy is magnetically stable after short-time exposure to temperatures up to 900°F. (A.C.)

9243

FORMATION OF NEGATIVE HYDROGEN IONS UPON PASSAGE OF POSITIVE HYDROGEN IONS THROUGH AN ULTRASONIC STREAM OF MERCURY VAPOR. Ya. M. Fogel', L. I. Krupnik, and V. A. Ankudinov. Zhur. Tekh. Fiz. 26, No. 6, 1208-21(1956). (Translated from Referat. Zhur. Fiz. No. 3, 1957, abstract no. 7165.)

A description is given of a setup and of a procedure developed for producing negative hydrogen ions, formed by passage of a beam of positive hydrogen ions through a mercury vapor-stream target. The optimum operating conditions of the setup are determined. The greatest number of negative ions occur at positive-ion energies of approximately 25 kev and at a stream thickness corresponding to a mercury temperature in the boiler of approximately 160°. The proposed source of negative ions has an intensity one order of magnitude greater (2 microamperes) than the Fite gas-discharge source. 15 references. (auth)

9244

TRANSITION BETWEEN HYPERFINE STRUCTURE LEVELS IN μ-MESIC HYDROGEN ATOMS. S. S. Gershtein (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 463-8(1958) Feb. (In Russian)

It is shown that due to the mechanism suggested by Ya. B. Zeldovich of a "jump" of μ^- mesons from one proton to another, mesic hydrogen atoms during the lifetime of the μ meson completely convert to the ground state of the hyperfine structure. A consequence of this is that the μ^- mesons are completely depolarized in hydrogen and that the neutrons produced in μ^--meson capture by protons $\mu^- + p \rightarrow n + \nu$ are totally polarized in the direction of their motion. (tr-auth)

Aerosols

9245 ORO-171

Weather Bureau, Oak Ridge, Tenn. and Oak Ridge Operations Office. Research and Development Div., AEC.

CALCULATIONS OF THE DEPOSITION OF AEROSOLS FROM ELEVATED SOURCES. Walter M. Culkowski. Feb. 14, 1958. 11p. $0.50(OTS).

The usefulness of the Sutton diffusion model in estimating concentrations of atmospheric effluents has recently been extended by Chamberlain, who has provided a discussion of the effects of ground deposition. Chamberlain's extension is derived from Sutton's diffusion formulas in which the diffusing puff or plume is assumed to possess a normal distribution of concentrations, having standard deviations in various coördinate directions that increase downward with the source. For the case of a source at ground level, Chamberlain's treatment of the deposition effect results in an easily evaluated, multiplicative correction to the appropriate Sutton formula. For an elevated source, however, such as a stack or explosion cloud, the Chamberlain deposition formula becomes fairly complex and is not easily evaluated. A simple computational technique is described for this purpose. The results of calculations are summarized in tables and graphs. (A.C.)

Cosmic Radiation

9246 IFA-EM-33

Academia R. P. R. Institutul de Fizică Atomică, Bucharest.

A HIGH ENERGY MESON SHOWER WITH AN ANOMALOUS ANGULAR SPREAD. (O Jerbă de Mare Energie Prezentînd o Divergentă Unghiulară Anomală.) E. M. Friedländer. 1956. 9p.

A star of the type 26 + 129 N was observed in a stratosphere-flown, glass-backed Ilford G-5 emulsion. The outstanding feature of the event is the large lateral spread of the shower particles, i.e., the absence of the well known two-cone structure which is characteristic for events of high multiplicity. It is shown that under the assumption of a nucleon-nucleon collision the value of the Lorentz factor (γ) cannot be reconciled with the observed multiplicity of the shower. The theories of either Heisenberg or Fermi-Landau yield still lower multiplicities and can even less explain the observed star. A possible explanation for this unusual event might be provided by the assumption that the incident particle is not a nucleon but a neutral pion. A computation based on this assumption does not contradict the experimental facts. (A.C.)

9247 NP-6682

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

ABOUT HIGH ENERGY INTERACTIONS IN NUCLEAR EMULSIONS. Report No. 11/VI. P. Ciok, T. Coghen, J. Gierula, R. Holynski, A. Jurak, M. Miesowicz, T. Saniewska, O. Stanisz, and J. Pernegr. Feb. 1958. 10p.

Thirty-six plates of the I-stack, which were exposed in the Po Valley expedition in 1955, were scanned for photon-electron cascades to find interactions of the highest energy. The plates were also area scanned for jets of lower energy. Measurements were made of the angular distribution of relativistic tracks. The energy of the colliding nucleons was determined for every jet. (W.D.M.)

9248

A LARGE COSMIC-RAY DECREASE ACCOMPANYING THE SOLAR MAXIMUM OF 1957. J. R. Winckler and

L. Peterson (Univ. of Minnesota, Minneapolis). Nature 181, 1317-19(1958) May 10.

Several observations of the general cosmic-ray level at balloon altitudes have been made which show a very large decrease in intensity during the spring and summer of 1957 compared with 1955 and 1956. The observations are of two types, the first made with a small Geiger counter vertical telescope of stopping power 0.2 g/cm^2, and the second with a combination of Geiger counter and ionization chamber. The 1957 measurements were made at latitudes of 51.2°, 55.3°, and 58.6° in June for comparison with the earlier measurements at latitudes from 51.2° to 64.2°. The vertical particle flux has decreased at all atmospheric depths less than 300 g/cm^2, and the change increases with decreasing depth until at high altitudes and high latitudes it almost reaches a factor of two. (W.D.M.)

9249

PRIMARY α-PARTICLE INTENSITY AT SUNSPOT MAXIMUM. P. S. Freier, E. P. Ney, and P. H. Fowler (Univ. of Minnesota, Minneapolis). Nature 181, 1319-21(1958) May 10.

In a series of balloon experiments, emulsion packages were included in each flight to allow the determination of the α-particle flux and energy spectrum at those times when total ionization or counting measurements showed that the total intensity had undergone a significant change. The decrease in the total intensity during the summer of 1957 was recorded in a number of flights in which satisfactory exposures were obtained. One flight made on May 17, 1957, has been analyzed and is reported. (W.D.M.)

9250

EXPLOSION SHOWERS PRODUCED BY HIGH ENERGY COSMIC RAY PARTICLES. I. I. Gurevich, A. P. Mishakova, B. A. Nikol'skii, and L. V. Surkova (Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 265-79(1958) Feb. (In Russian)

Experimental results are presented which pertain to 43 shower events induced by 10^{10} to 10^{14} ev nucleons and to 20 showers produced by particles with $Z \geq 2$. Asymmetry in the angular distribution of shower particles with respect to the angle $\pi/2$ in the center-of-mass system has been observed in showers produced by nucleons possessing an energy > 10^{11} ev. This fact is not consistent with the concept of shower production in nuclei in nucleon-nucleon collisions or with the predictions of the hydrodynamical theory of multiple production of particles proposed by Belen'kii and Landau. (tr-auth)

9251

HYPERFRAGMENTS IN NUCLEAR EMULSIONS. B. P. Bannik, U. G. Gulyamov, D. K. Kop'lova, A. A. Nomofilov, M. I. Podgoretskii, B. G. Rakhimbaev, and M. Usmanova (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 34, 286-97(1958) Feb. (In Russian)

The properties and relative frequency of appearance of hyperfragments were investigated. Some phenomena produced by other types of unstable heavy particles are also mentioned. (tr-auth)

9252

STUDY OF HIGH ENERGY NUCLEAR-ACTIVE PARTICLES WITH AN IONIZATION CHAMBER. G. T. Zatsepin, V. V. Krugovykh, E. A. Murzina, and S. I. Nikol'skii (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 298-300(1958) Feb. (In Russian)

Nuclear-active particles possessing energies above 10^{11} ev were studied at an altitude of 3860 m above sea level by means of ionization chambers placed under absorbers of various thicknesses and of a counter hodoscope. Integral spectra of ionization bursts in the chambers are presented and conclusions are drawn regarding the absorption mean free path in air and in lead of nuclear-active particles with energies > 10^{11} ev. (tr-auth)

9253

THE SPATIAL DISTRIBUTION OF PHOTONS NEAR THE AXES OF EXTENSIVE ATMOSPHERIC SHOWERS. A. A. Emel'yanov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 516-18 (1958) Feb. (In Russian)

Crystallography and Crystal Structure

9254 NP-6700

STATISTISCHE SCHWANKUNGEN DER VON EINEM PRIMÄRTEILCHEN ERZEUGTEN FRENKELDEFEKTE. (Statistical Oscillations of the Frenkel Defect Produced by a Primary Particle.) G. Leibfried. [1957]. 8p.

For the probability $W_\nu(E)$ that a primary particle (primary knock-on) of energy E will produce a Frenkel pair ν, an integral equation was formulated. From this equation was derived, in a simple manner, the integral equation for the average value of the power of ν. The model of Kinchin and Pease and the impact law of hard spheres is used as the basis for the cascade production, so that for $\bar{\nu}(E)$ one obtains the known, linear, and homogeneous integral equation with $\bar{\nu}(E) = E/2E_d$ when the solution $E \geq 2E_d$, where E_d is the energy for freeing an atom from its lattice place. For $\overline{\nu^2}(E)$ one obtains the same integral equation with an inhomogeneity which contains the known $\bar{\nu}$. The solution of this equation yields for the oscillation square a surprisingly small value $\overline{\nu^2} - \bar{\nu}^2 = 0.15\bar{\nu}(\nu \geq 2)$. These results show that the larger cascades, as those produced by neutrons, may be calculated partially with rigorous ν values. (tr-auth)

9255

A LEAST-SQUARES ANALYSIS OF THE DIFFUSE X-RAY SCATTERING FROM CARBONS. R. Diamond (Cavendish Lab., Cambridge, Eng.). Acta Cryst. 11, 129-38(1958) Mar.

The theoretical x-ray intensities scattered from perfectly regular, condensed, aromatic molecules of various sizes have been presented previously in numerical form. A matrix method is described whereby a linear combination of such theoretical curves may be fitted to the observed intensities with minimum total square error; the coefficients in the combination so found at once provide an estimate of the distribution of molecular sizes within the material. Some features of the method are briefly discussed and some experimental examples are given. (auth)

9256

ON THE PRECISION OF RÖNTGENOGRAPHIC STRESS MEASUREMENTS, PARTICULARLY WITH WIDE LINES. Ulrich Wolfstieg (Versuchsanstalt der Bochumer Verein für Gussstahlfabrikation AG, Bochum, German). Acta Cryst. 11, 145-8(1958) Mar. (In German)

The measurement of stresses by x-ray methods is usually considered to gain in precision as the back-reflection angle is reduced. This result is true only if the line width is effectively determined by the slit width and is therefore independent of the angle. If, however, the main cause for the observed line width is stress inhomogeneity, or if there is an appreciable instrumental uncertainty in the readings of the line position, then the error in the relative change of the interplanar distance is independent of the back-reflection angle and of the distance from the sample to the plane film. The possibility of determining stresses by means of fairly wide lines removes hitherto embarrassing restrictions on the application of the method. (auth)

9257

PHASE DETERMINATION FROM NEW JOINT PROBABILITY DISTRIBUTIONS: SPACE GROUP P$\bar{1}$. H. Hauptman and J. Karle (U. S. Naval Research Lab., Washington). Acta Cryst. 11, 149-57(1958) Mar.

New joint probability distributions of several normalized structure factors are obtained by fixing the crystal structure and allowing the indices to range uniformly but not independently over the vectors in reciprocal space. From these the expected values of the product of powers of several structure factors are found. A subsequent integrating process, together with an important identity, then yield greatly improved formulas for phase determination by means of which the phases of the structure factors are obtainable from the magnitudes of the structure factors alone. Owing to the greater power of these formulas the data are used more efficiently, and complex structures may be more readily analyzed than heretofore. (auth)

9258

COMPLEX ALLOY STRUCTURES REGARDED AS SPHERE PACKINGS. I. DEFINITIONS AND BASIC PRINCIPLES. F. C. Frank (Univ. of Bristol, Eng.) and J. S. Kasper (General Electric Co., Schenectady, N. Y.). Acta Cryst. 11, 184-90(1958) Mar.

Complex alloy structures, particularly those of transition metals, are considered as determined by the geometrical requirements for sphere packing. A characteristic of the class of structures discussed is that tetrahedral groupings of atoms occur everywhere in the structure—alternatively stated, coördination polyhedra have only triangular faces. The topological and geometrical properties of such polyhedra are examined and rules and theorems regarding them are deduced. Justification is given for the prominence of four such polyhedra (for coördination numbers of 12, 14, 15, and 16) in actual structures. General principles regarding the combination of these polyhedra into full structures are deduced and necessary definitions are given for terms that facilitate the detailed discussion of this class of structures. (auth)

9259

INFLUENCE OF THE SIZE OF CRYSTAL GRAINS ON CHARACTERISTICS OF THE FLASH LIKE RISE OF LUMINESCENCE IN ZnS—Mn PHOSPHORS. Z. S. Mansurova. Optika i Spektroskopiya 4, 529-32(1958) Apr. (In Russian)

An x-ray analysis was made of the crystal structure of crushed specimens of ZnS—Mn phosphors obtained at annealing temperatures of 1160° and 850°. From the observations it was shown that each fraction had its maximum flash magnitude; however, the optimal time of the maximum flash moment was constant for all fractions. It was shown that the drop in luminescence magnitude for the small or crushed grains of ZnS—Mn is not related to the transitions from one modification to another. The intensity of the Mn band stationary luminescence (with error) does not depend on the size of the grain. The differences in the behavior of the stationary luminescence and the absolute flash luminescence in crushed specimens show that the luminescence centers and the centers of the first and second localization react differently to the surface development during crushing. Hence, it was assumed that the magnitude of the relative flash depends on the crystal surface (i.e., on the exposure or isolation of the grain surface from contact with the atmosphere during annealing). (R.V.J.)

9260

ELECTRICAL METHODS FOR DETERMINING THE POSITIONS OF DISLOCATION REGIONS IN GERMANIUM. C. A. Hogarth and A. C. Baynham (Royal Radar Establishment, Great Malvern, Eng.). Proc. Phys. Soc. (London) 71, 647-53(1958) Apr.

It is shown that the walls of edge dislocations which exist in germanium crystals grown on a deformed seed are regions of high electrical conductivity in both n- and p-type samples. By means of simple plotting of potential against distance at constant current or from point-contact rectification measurements the positions of such dislocation walls may be located, the results agreeing with the positions determined by etch pit examination of the surfaces at which dislocations emerge. Evidence of the p-type character of dislocations in n-type germanium is presented. (auth)

9261

CRYSTALLOGRAPHIC STUDY OF ARTIFICIAL CARNOTITE. M. Jiménez de Abeledo, M. Rodríguez de Benyacar, and R. Poljak. Publs. com. nacl. energia atomica (Buenos Aires) Ser. Fis. 1, No. 14, 243-59(1957). (In Spanish)

Results are presented on the synthesis and crystallographic study of potassium uranyl vanadate (synthetic carnotite anhydride). The carnotite was prepared by reaction of ammonium uranate with an excess of potassium meta-vanadate at the fusion temperature. The crystal structure and optical properties were determined. X-ray and electron-diffraction studies were made. (J.S.R.)

9262

THE ACTIVATION ENERGIES FOR CREEP OF SINGLE ALUMINUM CRYSTALS FAVORABLY ORIENTED FOR (1 1 1) [$\bar{1}$ 0 1] SLIP. J. L. Lytton, L. A. Shepard, and J. E. Dorn (Univ. of California, Berkeley). Trans. Met. Soc. AIME 212, 220-5(1958) Apr.

Single aluminum crystals were subjected to creep in simple shear on the (1 1 1) planes in the slip direction. The activation energies for creep were calculated from the effect of small abrupt changes in temperature on the creep rate just before and immediately following the temperature change. The results definitely establish the fact that creep of single aluminum crystals occurs by three unique processes, characterized by three distinct and isolatable activation energies: The 35,500-cal-per-mole activation energy obtained at the highest temperatures was ascribed to a dislocation climb process; the 28,000-cal-per-mole activation-energy process, occurring over the intermediate-temperature range was attributed to a cross-slip mechanism; and it was suggested that the 3400-cal-per-mole process observed below 400°K may be the Peierls energy. (auth)

9263

THE EFFECT OF SURFACE FILMS ON THE CREEP OF CADMIUM CRYSTALS. M. Metzger and T. A. Read (Univ. of Illinois, Urbana). Trans. Met. Soc. AIME 212, 236-43 (1958) Apr.

The strengthening effects of hydroxide and synthetic plastic films in the creep of cadmium crystals were studied. The results were broadly consistent with the naive mechanical model. The dislocation-film reactions and the significance of the macroscopic stresses associated with certain films are discussed in the paper. (auth)

9264

PYRAMIDAL SLIP IN MAGNESIUM. R. E. Reed-Hill (U. S. Coast Guard Academy, New London, Conn.) and W. D. Robertson (Yale Univ., New Haven, Conn.). Trans. Met. Soc. AIME 212, 256-9(1958) Apr.

Slip on $\{11\bar{2}2\}$ planes, which do not contain a close-packed direction, has been identified on crystals strained at −190°C. Evidence is also presented to show that $\{10\bar{1}1\}$ pyramidal slip is a mode of deformation at 25°C in a limited orientation range. (auth)

9265
SIZE EFFECTS IN THE DEFORMATION OF ALUMINUM. R. L. Fleischer (Massachusetts Inst. of Tech., Cambridge) and Bruce Chalmers (Harvard Univ., Cambridge, Mass.). Trans. Met. Soc. AIME 212, 265-74(1958) Apr.

In order to observe size effects associated with a grain boundary, aluminum single crystals and bicrystals of various cross-sectional dimensions were deformed in tension. Typical stress-strain curves are presented in conjunction with measurements of the effects of changes in crystal dimensions. Some effects of the growth rate used in preparation of crystals are also described. It is indicated that the macroscopic constraints at a grain boundary are responsible for the most prominent grain-boundary effect, the production of multiple slip. Two measurements of the width of the region of double slip are in agreement. It is concluded that the yield stress of aluminum is affected markedly by the inherent oxide coating. (auth)

Electrical Discharge

9266
USE OF SPECTRAL LINE BROADENING IN DETERMINATIONS OF ATOMIC CONCENTRATIONS IN A. C. ARC DISCHARGE PLASMA. I. M. Nagibina (Leningrad Inst. of Precision Mechanics and Optics). Optika i Spektroskopiya 4, 430-7(1958) Apr. (In Russian)

Concentrations of neutral atoms and ions in the arc discharge cloud glowing between carbon electrodes were measured using the irreversible resonance line broadening. The linear dependence between the line width and the concentration in the discharge cloud was confirmed. The ratio between the atomic concentration in the discharge cloud and on the carbon electrode was determined on a thinly coated electrode. (tr-auth)

9267
INVESTIGATION OF POWERFUL PULSE DISCHARGE WITH LIMITED CHANNEL DIAMETER. N. N. Ogurtsov and I. V. Podmoshenskii (Vavilov State Inst. of Optics). Optika i Spektroskopiya 4, 539-41(1958) Apr. (In Russian)

9268
THE LONGITUDINAL PRESSURE GRADIENT IN DISCHARGE TUBES. R. B. Cairns and K. G. Emeléus (Queen's Univ., Belfast). Proc. Phys. Soc. (London) 71, 694-8(1958) Apr.

A pressure gradient, which may be accompanied by convection, can be produced along the positive column of a discharge tube because of (a) transport of gas as positive ions, (b) action of the longitudinal field on the positive space-charge in the plasma and sheaths, and (c) difference in the momentum given to the wall by positive ions and electrons leading to a compensating reaction on the gas. The first two effects tend to increase the pressure near the cathode, the last to increase the pressure near the anode. It is found experimentally that the pressure is greatest near the anode at relatively high pressures, and greatest near the cathode at lower pressures. In this note, some experiments with tubes of simple geometry are described which provide fresh data for the higher-pressure range and show the beginning of the transition to the lower pressure regime. (A.C.)

9269
CONTRIBUTION TO NONLINEAR THEORY OF OSCILLATIONS IN PLASMA. A. I. Akhiyezer, G. Ya. Lyugarskiy, and Ya. B. Faynberg. Uchenye Zapiski Khar'kovsk. 64, 73-80(1956). (Translated from Referat. Zhur. Fiz. No. 3, 1957, abstract no. 7148.)

Because of the mathematical difficulties encountered in the solution of the rigorous nonlinear problem of oscillations in plasma, only three particular cases were considered. Oscillations occurring upon interaction of an electron beam with the plasma at absolute zero were studied. The excitation of plasma by an infinite charged plane was considered. A considerable portion of the work is devoted to the consideration of nonlinear oscillations excited in plasma in the cases of temperature other than zero. While in the first two cases the hydrodynamic approximation was used exclusively, in the latter case the plasma is represented by the kinetic equation. The results obtained are compared with the results of the linear theory. (auth)

9270
REVOLVING PLASMA. V. G. Stepanov, V. F. Zakharchenko, and V. S. Bezel (Ural Polytechnic Inst.). Zhur. Eksptl'. i Teoret. Fiz. 34, 512-13(1958) Feb. (In Russian)

Measurements were made of the forces acting upon a rotating plasma in an ionized gas located in a magnetic field. The density of the charged particles was in the range 10^{11} to 10^{12}, and the density of gas interacting with the rotating plasma was about 10^{17}, which is about the density of mercury vapor. (R.V.J.)

9271
THE PROBLEM ON THE ABSORPTION OF ELECTROMAGNETIC WAVES IN THE RESONANCE RANGE OF HETEROGENEOUS PLASMA. N. G. Denisov (Gor'kii State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 528-9(1958) Feb. (In Russian)

9272
A CONTRIBUTION TO THE KNOWLEDGE OF UNFOCUSED ARC DISCHARGE. W. Haidinger (N. V. Philips-Gloeilampenfabrieken, Eindhoven, Holland). Z. Physik 151, 106-13(1957). (In German)

In a xenon high-pressure discharge with short arc length it was shown that the transition from the focused arc to the unfocused arc was dependent on the form and emission of the cathode. A special cathode with which, under the same conditions, the transition current dropped about 40% is described. These cathodes can be prepared with lightly emitting material so that the transition current intensity diminishes more than 85%. In these unfocused arcs a reignition peak was observed at small current intensities (low cathode temperature) in contrast with previous experiments. (tr-auth)

9273
THE ELECTRIC CONDUCTIVITY OF A PLASMA. I. H. Schirmer and J. Friedrich (Osram-Studiengesellschaft, Berlin). Z. Physik 151, 174-86(1958). (In German)

With consideration of the electron interactions, the exact theory of the electric conductivity of a plasma (in the presence of a weak electric field) was constructed by integration of the Boltzmann equation of ionized gases. The development included plasmas of any ionizing degree without any simplifications up to the fourth approximation; it contained, therefore, the results of Landshoff and other authors which had been derived as a special case using simplified hypotheses only for completely ionized gases. The consequent transfer of the cross section conception to the inelastic-elastic scattering centers makes possible an obvious interpretation of the results in the direction of the elementary idea of free paths. (tr-auth)

Electrons

9274 AERE-Trans-11/3/5/1018
THERMIONIC ELECTRONS. M. von Laue. Translated

by F. Hudswell from Jahrb. Radioakt. u. Elektronik 15, 205-56(1918). 60p.

The most important result of this investigation is that the thermionic electrons in the equilibrium state form a layer which adjoins the thermionic electrodes. When the external effects are not too strong, this layer has an energy, entropy, and charge per unit area which are characteristic of the electrode material and the temperature, and it has a negative surface tension which results in a negative capillary pressure for surfaces which are curved. The limiting density at a thermionic electrode is determined as a function of the temperature through the position of the electrode material in the voltaic electromotive series, and by a universal constant. (W.D.M.)

9275

THE PROBLEM OF THE ENERGY SPECTRUM OF ELECTRONS IN DEFINITE PERIODIC TRAJECTORIES. G. E. Zil'berman. Zhur. Eksptl'. i Teoret. Fiz. 34, 515-16(1958) Feb. (In Russian)

Gases

9276 T-81(RAND)

THE EQUATION OF STATE OF HYDROGEN AT HIGH PRESSURES. A. A. Abrikosov. Translated by Margaret Kivelson from Astron. Zhur. 31, 112-23(1954). 26p.

The equation of state of hydrogen is examined for $P > 2 \times 10^6$ atm. At 2.4×10^6 atm. there exists a transition from the molecular to the atomic modification accompanied by a discontinuous increase in the density from 0.621 g/cm^3 to 1.12 gm/cm^3. The limits of applicability of the calculations are explored. (auth)

9277

ON THE PHYSICS OF IONIZED GASES. V. D. Shafranov. Atomnaya Energiya 3, No. 10, 356-7(1957).

The titles of the more important papers presented at the 3rd International conference on the Physical Phenomena in Ionized Gase which was held in Venice from June 11 to June 15, 1957, are given. (J.S.R.)

9278

INERT GASES AND THE EVOLUTION OF THE ATMOSPHERE. Paul E. Damon and J. Laurence Kulp (Lamont Geological Observatory, Palisades, N. Y.). Geochim. et Cosmochim. Acta 13, 280-92(1958).

The origin of the present isotopic composition of the inert gases in the atmosphere is reviewed. Using new data on the maximum rate of tritium, and hence He^3, production in the atmosphere, the present rate of escape of He^4 and Ar^{40} from the crust can be calculated. It is found that this rate is far too small to account for the quantity of Ar^{40} in the atmosphere and that most of the Ar^{40} presumably accompanied by some nitrogen and water was introduced into the atmosphere in the first billion years of earth history from the mantle and crust. (auth)

9279

THE EXCITATION OF THE 2p STATE OF HYDROGEN BY SLOW ELECTRONS—DISTORTED WAVE TREATMENT. S. Khashaba and H. S. W. Massey (Univ. Coll., London). Proc. Phys. Soc. (London) 71, 574-84(1958) Apr.

The distorted wave method is applied to the calculation of the cross sections for excitation of the 2p state of hydrogen by impact of electrons with energies between 13.5 and 54 ev. The polarization of impact radiation emitted from the 2p state when excited by an electron beam is also calculated. Comparison of results obtained using the Born–Oppenheimer approximation shows that the effect of distortion on the total cross section is not as great as for the excitation of the 2s state. It is pointed out that coupling between the 2s and 2p states which has been neglected in all calculations may be important. (auth)

Instruments

9280 CF-57-2-1

Oak Ridge National Lab., Tenn.

INSTRUMENTATION FLOW PLAN SYMBOLS AND RECOMMENDED DRAWINGS. A STANDARD SYSTEM FOR ORNL INSTRUMENTATION APPLICATION WORK. R. K. Adams, D. G. Davis, and R. F. Hyland. Feb. 21, 1958. 30p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70 (mf OTS).

A system of symbols and identifications for process-instrumentation equipment to promote a uniformity of practice is presented. The system is for the following uses: designation and identification of instruments on flow plans; recording specifications, listings, requisitions, and purchase orders; indication of items on piping diagrams and other construction drawings; identification tagging of equipment; and description in technical and trade literature. (J.S.R.)

9281 DP-263

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

A DIFFERENTIAL TRANSFORMER GAUGE FOR OUTSIDE AND INSIDE DIAMETERS OF LONG TUBES. Leslie E. Goodwin. Jan. 1958. 15p. Contract AT(07-2)-1. $0.50 (OTS).

An instrument is described which measures the outside and inside diameters of tubes twenty feet long. The outside and inside diameters are approximately 3.5 and 3.0 inches, respectively. Linear variable differential transformers mounted in special probes are used as the "sensing" elements. The dimensions are measured with an accuracy of ±0.001 inch. Both diameters can be measured continuously as the probes are pushed down the length of the tube. (auth)

9282 RIB-29

David Sarnoff Research Center, Princeton, N. J.

DEVELOPMENT OF HIGH SPEED ELECTRON ACCELERATOR STRUCTURES. Quarterly Report No. 6 [for] November 1, 1957–January 31, 1958. M. H. Greenblatt, R. M. Matheson, A. H. Sommer, and G. O. Fowler. Apr. 29, 1958. 20p. Contract AT(30-1)-1958. $3.30(ph OTS); $2.40(mf OTS).

To obtain a satisfactory design for high-voltage tube operation in the central electrode structure, more detailed information about the position and shape of the electron orbits than can be obtained from the usual multiplier structure is necessary. The arrangement of an oversize structure in a demountable vacuum system for this purpose is given. The transit-time dispersion in the high-voltage, central electrode measuring tube was measured at 200 mc. An analysis was performed of the detail of the mechanics of electron deflection at high frequencies where the transit angle of an electron beam under the deflecting plates may be a large fraction of a period of the deflection voltage. The light beam splitting arrangement has been assembled and tested. A type C7251 multiplier tube made at Lancaster was measured for transit time dispersion in the photocathode space. The electrical properties of the anode structure, leads, tube base, and sockets of several tubes were examined by using the tube as the termination of a transmission line. (For preceding period see RIB-27.) (J.S.R.)

9283 AEC-tr-3131

SURFACE THERMOMETER. E. Brun and L. Castel. Translated by K. S. Bevis from J. recherches centre natl.

recherche sci. Labs. Bellevue (Paris). No. 10, 21-2(1950). 4p.

A thermoelectric thermometer for measuring surface temperatures is described. Readings are quickly and easily made. The temperature to be measured is not appreciably altered by flux perturbations caused by the presence of foreign material on the surface. (A.C.)

9284

A NEW APPROACH TO THE MEASUREMENT OF COATING THICKNESS BY FLUORESCENT X-RAY ABSORPTION. Fred A. Achey and Earl J. Serfass (Lehigh Univ., Bethlehem, Penna.). J. Electrochem. Soc. 105, 204-5(1958) Apr.

Absorption of x-ray fluorescence from the base metal of a plated sample is the most frequently used x-ray method for coating thickness determinations. If both coating and base metal yield fluorescent x-rays, it is necessary to isolate the base metal fluorescence before measurement. Balanced filters are used for isolating the fluorescence from the base metal, and results show close agreement with crystal reflection techniques. Simplicity of the method, together with low equipment cost and high accuracy, recommend it as a useful tool in measuring plating thicknesses. (auth)

9285

MEASUREMENT OF INTENSE BEAMS OF THERMAL RADIATION. A. Broido and A. B. Willoughby (U. S. Naval Radiological Defense Lab., San Francisco). J. Opt. Soc. Amer. 48, 344-50(1958) Apr.

Thermal radiation calorimeters have been constructed with relatively thick receivers which permit the direct recording of integrated thermal energy dose as a function of time. However, it is shown that with proper receiver design the rate of change of recorded temperature can be made proportional to the rate of delivery of energy within a reasonably short time constant. Thus, differentiation of the recorded temperature data will give an accurate picture of the irradiance-time history of an impinging pulse. Several hundred calorimeters have been successfully used, both in the laboratory and in the field, to measure, with a time constant of 20 milliseconds or less, radiant energy pulses up to 100 cal/sq cm with peak irradiances up to 200 cal/sq cm/sec. The primary advantages of the instruments are that they are small, simple, rugged, and that they provide a signal which may be recorded without complex amplification equipment directly on a high speed oscillographic recorder. (auth)

9286

A STUDY OF TEMPERATURE MEASUREMENT IN A SOLAR FURNACE. Byron B. Brenden, Herbert W. Newkirk, Jr., and Sidney H. Woodcock (General Electric Co., Richland, Wash.). J. Solar Energy Sci. Eng. 2, 13-17(1958) Jan.

A survey indicates that thermocouples and two-color pyrometers can be used to measure accurately the temperature of a specimen being heated in a solar furnace. The thermocouples found to be most satisfactory and accurate to $\pm\frac{3}{4}$ per cent in the range room temperature to 1100°C are chromel–constantan, chromel–alumel, useful in oxidizing atmospheres, Driver-Harris, No. 242 (Geminol P) vs. No. 33 (Geminol N), useful in neutral and reducing atmospheres. The range 1100°C to 3500°C can be determined by means of a two-color pyrometer with an accuracy of better than ±10°C. Both instruments, if properly designed, have been demonstrated to be independent of the emissivity of the specimen and the environmental conditions existing in a solar furnace. In addition, the two-color pyrometer can be used in conjunction with a conventional brightness pyrometer to determine the effective emissivity of the specimen in the spectral band passed by the brightness pyrometer. (auth)

9287

A DEVICE FOR THE OBSERVATION OF THE CURRENT DISTRIBUTION IN AN ACCELERATED ION BEAM AT A CYCLOTRON TARGET. Yu. V. Korshunov, Ye. A. Meleshko, and V. S. Panasyuk. Pribory i Tek. Ekspt. No. 2, 23-4(1957).

In many investigations associated with the adjustment and focusing of the emitted particle beam, it is necessary to determine the beam current distribution at the target surface. This is usually achieved by means of a probe connected to ground through calibrated resistors. The voltage drop across these resistances, due to ion current, is usually measured by a calibrated d-c amplifier. A short description of the electronic commutator used for this purpose is given. The ion current distribution is displayed on a CRT screen. The use of the commutator shortens the time of the measurements and also provides a control and adjustment of the cyclotron. The device may also be used for obtaining the particle spectrum in mass spectrography. (TCO)

9288

A LOW NOISE LEVEL PRE-AMPLIFIER. V. G. Brovchenko and Yu. D. Molchanov. Pribory i Tek. Ekspt. No. 2, 67-70(1957).

A low noise pre-amplifier built for use with ionization chambers and with proportional counters is described. The first stage of the amplifier is a "cascade" using two grounded cathodes in parallel and a parallel grounded grid double triode. The noise level of the pre-amplifier is determined mainly by the anode current fluctuations in the input stage and is 2 μv for a pass band 50 kc/s to 1.1 Mc/s, input capacity of about 11 pF and V_a of 75 v. The pre-amplifier gain is 140 with the pass band 5 Mc/s to 600 cps. The further two stages of the pre-amplifier consist of a pentode and a double triode; a heavy current feed-back is applied. The anode supply is stabilized, and d-c is used for the heater chain; the total gain of the last three stages is 170 with feed-back and about 4000 without feed-back. The whole arrangement is very stable, has a very good linearity, and has been giving very good service in high precision physical instrumentation for the last three years. The circuit diagram of the pre-amplifier is given. (TCO)

9289

A DIFFERENTIAL ELECTRONIC FLUXMETER. V. I. Danilov, Yu. N. Denisov, and V. P. Dmitriyevskiy. Pribory i Tek. Ekspt. No. 2, 74-7(1957).

An instrument for measuring sharply inhomogeneous magnetic fields is described. The probe element consists of two calibrated coils wound in opposition and differing in their characteristics by not more than 0.002%. The rotation of coils, which are both wound on the same former, is achieved with the help of a special current-excited winding. The electronic part of the arrangement consists of an integrating network, of an inductively coupled amplifier, of a peak reading voltmeter, and of a remote-control arrangement. The characteristic constant of the instrument was determined from measurements on a known magnetic field. The sensitivity obtained for the instrument was 0.027 oersted/cm/division. A mechanical drawing of the coil arrangement and a circuit diagram of the electronic part of the instrument are given. (TCO)

9290

ASYMMETRY OF THE OPTICAL SYSTEM OF AN ELECTROSTATIC MICROSCOPE AND ITS RESOLVING POWER. D. V. Fetisov and V. I. Milyutin. Radiotekh. i Elektron. 2, No. 4, 488-93(1957).

An experimental investigation of the effect of the asymmetry of a lens and of the asymmetry of a system of lenses on the resolving power of an electrostatic microscope is described. The experiments were carried out on the

Soviet-made microscope which was especially adapted for the investigation. The investigated lens consisted of three diaphragms; the middle diaphragm could easily be removed and its axial position could be changed with respect to the remaining diaphragms. The resolving power of the microscope was first measured as a function of the radial asymmetry (ellipticity) of the aperture of the middle diaphragm. The asymmetry was defined as the difference Δa between the maximum and the minimum diameters of the aperture. It was found that for Δa up to 4 μ, the resolving power δ is constant and equal to about 60 A; for Δa between 4 and 14 μ δ is proportional to Δa and at 14 μ it is equal to about 100 A. It was also found that δ is a linear function of the axial asymmetry of the middle diaphragm and that of the upper diaphragm. In order to achieve δ of about 60 A, it was found necessary to preserve the axial symmetry of the upper diaphragm to within 5% and that of the middle diaphragm to 0.4%. In a two-lens system, the axial asymmetry of the projection lens for δ = 60 A could be of the order of 1.0 mm, while in a three-lens microscope the asymmetry of the center lens had to be less than 0.15 mm. (TCO)

Isotope Separation

9291 HEC-87

Hooker Electrochemical Co., Niagara Falls, N. Y.
QUARTERLY AEC RESEARCH AND DEVELOPMENT REPORT FOR JANUARY, FEBRUARY AND MARCH 1958. George T. Miller. Apr. 17, 1958. 17p. Contract AT(30-1)-1524. $3.30(ph OTS); $2.40(mf OTS).

A new method of separating boron isotopes by exchange between a liquid boron trifluoride complex and a solid boron trifluoride complex was investigated. The results were negative. The effect of additives to the fused salt electrolyte in the cell for the production of elemental boron yielded some unpredicted results. The addition of aluminum fluoride monohydrate improved the crystallinity of the deposit. The addition of elemental aluminum apparently improved the crystallinity, yield and purity of the product. An unpredicted improvement in yield and purity of elemental boron resulted when water was added to the electrolyte. Although sulfates had no apparent effect, nickel, Inconel and vanadium had deleterious effects on yield and purity of boron. An apparent major variable in the fused salt electrolytic method for the production of elemental boron is the microporosity of the graphite. The presence of microfissures in the graphite permit contamination of the product by corrosion products from the anode shell. A method for reclaiming boron values from spent electrolyte was developed and put into operation. The method is one of fractional recrystallization. (For preceding period see HEC-83.) (auth)

9292 AEC-tr-3157

THE SEPARATION OF GERMANIUM AND MAGNESIUM ISOTOPES IN A SMALL ELECTROMAGNETIC CIRCULATOR. V. M. Gusen, D. V. Chkuaseli, and M. I. Guseva. Translated from Atomnaya Energ. 3, 215-21(1957). 12p.

A description is given of the method of electromagnetic separation of germanium and magnesium isotopes in a small electromagnetic separator with a focusing angle of 180°. The construction of an ion source and ion collector (isotope collector) is examined. The ion source in which the discharge is maintained functions satisfactorily in the temperature region up to 1500°C. The construction of the receiver provides for the simultaneous recovery of all the isotopes of the separated element. The dependence of the magnitude of the ion current, focused on the source, on the discharge system in the source was investigated. During the separation process for germanium isotopes, the ion current at the receiver reached 15 to 20 ma, during the separation of magnesium, 35 to 40 ma. In the pockets of the receiver ~40 mg of enriched germanium isotopes (or ~25 mg of enriched magnesium isotopes) were collected every hour. The recovery coefficient of the substance was 2 to 6%. A mass spectrometric analysis of the enriched germanium isotopes was carried out on metallic samples, those of magnesium isotopes on an MgI_2 compound. The attained enrichment coefficient of germanium and magnesium lies within the intervals of 17 to 175 depending on the natural abundance and isotopic mass. (auth)

9293

EQUILIBRIUM CONSTANTS FOR BORON ISOTOPE EXCHANGE REACTIONS. Slobodan V. Ribnikar. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 31-41(1958) Mar.

The rate and magnitude of the boron isotope exchange reactions between boron trifluoride gas and its liquid compounds with ethyl ether, n-butyl ether, ethyl formate and water are investigated. The direction of the enrichment of B^{10} is found to be in the liquid phases, with equilibrium constants being between 1.025 and 1.031 at 20°C. (auth)

9294

PHYSICAL PRINCIPLES OF THE TRENNDUSE METHOD. PART II. G. Nardelli and A. Repanai. Energia nucleare (Milan) 5, 247-60(1958) Apr. (In Italian)

In this second part of "Physical Principles of the Trenndüse Method," a probable interpretation is given of the mass transport phenomena as were observed by Becker et al. in their analysis work on gaseous isotope mixtures. The interpretation is based on gases diffusion theory and is given in two limit approximation schemes, i.e., diffusion among tubes of a fluid current and free-diffusion, from a point source, of molecular rays distributed in accordance with the Maxwell Law. It has been found that such effect is mainly due to the pressure diffusion within a supersonic jet. (auth)

9295

ELECTROMAGNETIC ISOTOPE SEPARATOR IN GOTHENBURG. O. Almen, G. Bruce, and A. Lunden (Chalmers Univ. of Tech., Gothenburg). Nuclear Instr. 2, 249-60(1958) Apr.

A 90° electromagnetic isotope separator with a beam radius of 100 cm is described. Using an acceleration voltage of 50 kv, ion currents of up to a few hundred μa can be handled. The ion current and resolving power can be varied within wide limits by adjusting the position of the lens system during operation. Two types of magnetic ion sources have been used to prepare targets for nuclear reaction studies and samples for beta- and gamma-ray spectroscopy. (auth)

9296

TO THE THEORY OF SEPARATION OF STABLE ISOTOPES. V. K. Turkin (Moscow Chemical-Technological Inst.). Trudy Moskov. Khim. Tekhnol. in-ta 22, 247-51 (1956). (Translated from Referat. Zhur. Khim. No. 8, 1957, abstract no. 26032).

Formulas for the computation of cascades for separating isotopes with an arbitrary number of steps were derived. The equation $P = \theta_s L_s - (1 - \theta_{s+1})L_{s+1}$ (1) is accurate for the step numbered s; P is the flow out of the cascade, L is the flow to the given step, θL is the enriched flow from the step, and $(1 - \theta)$L is the impoverished out flow. (1) is an equation of finite differences of the first order in respect of L_s. If $\theta_s = \theta$ = const (particular case), the solution of

this equation has the following form: $L_s = [P/(2\theta - 1)]\,[1 - (1-\theta)/\theta^{p-s+1}]$, where p is the total number of steps in the cascade. Expressions for the concentration of the isotope N_s under consideration in the inflow to the step and of the concentrations N_s' and N_s'' in the enriched and impoverished flows leaving the step were derived in an analogous way.

9297

SEPARATION OF ISOTOPES IN A NON-STATIONARY MOLECULAR FLOW. K. D. Sinel'nikov, V. E. Ivanov, B. G. Safronov, Yu. S. Azovskii, and G. G. Aseev. Zhur. Eksptl'. i Teoret. Fiz. 34, 327-30(1958) Feb. (In Russian)

A change in the isotopic composition was detected in a non-stationary molecular flow of mercury vapor. The time of absorption of mercury on an iron surface ($\tau_e^{198} = 3.4 \times 10^{-2}$ sec for T = 293°K) and the ratio of the absorption times for the Hg^{198} and Hg^{204} isotopes ($\tau_e^{198}/\tau_e^{204} = 1.008$) were computed from the results obtained. The heat of absorption of mercury on iron (15×10^3 cal/mole) is estimated. (tr-auth)

9298

CONCENTRATION OF HEAVY NITROGEN ISOTOPE BY THERMODIFFUSION. B. A. Geller. Zhur. Fiz. Khim. 30, No. 8, 1871-6(1956). (Translated from Referat. Zhur. Khim. No. 8, 1957, abstract no. 26033).

The concentration of N^{15} was carried out in a cascade of 6 columns (C) of 3.5 m each and one column of 1 m. Nickel – chromium filaments 0.6 mm in diameter, the temperature of which was about 800°, were drawn along the centers of separating copper tubes 10 mm in diameter. The speed of circulation of gas in C was about 0.4 liter per hour. The installation, filled at 1 atm. with the N_2 free of Ar and containing 0.1% of O_2, worked according to the cascade scheme. The first 4 C were connected parallel, each of them had a tank (T) of 36 liter capacity on the top, the bottom T were connected together, and N_2 was pumped from them up to the fifth C. The remaining C were connected in series. The total efficiency (E) of the cascade was 410 theoretical plates (TP). After 6 days the enrichment of N^{15} at the "heavy" end reached about 4%, after which all the C were switched in series with one upper T at the starting end of the installation. Then the E of the cascade was 730 theoretical plates. 54 days later the concentration of N^{15} reached 11.5%. After that and in the duration of 72 days, the concentrated of N^{15} was removed and transferred into NH_4Cl through Ca and Mg nitrides. 6.1 g of NH_4Cl, containing from 1.2 to 9% of N^{15}, were produced in 213 days. The maximum concentration of N^{15} obtained was 12.9%. A satisfactory agreement with the theory of isotope separation by thermodiffusion was obtained. The kinetics of enrichment and the distribution of N^{15} along the installation were studied.

9299

THE COEFFICIENT OF SEPARATION OF LIQUID BCl_3 AND ITS VAPOR BY CHLORINE ISOTOPES. M. Ya. Kats, G. M. Kukavadze, and R. L. Serdyuk. Zhur. Tekh. Fiz. 26, No. 10, 2401-2(1956). (Translated from Referat. Zhur. Khim. No. 8, 1957, abstract no. 26035).

As the result of BCl_3 rectification at 23°, the ratio of isotopes B^{11}/B^{10} was altered from 4.13 ± 0.02 to 3.60 ± 0.02, and that of Cl^{35}/Cl^{37} from 3.05 ± 0.02 to 2.94 ± 0.02. Provided the number of theoretical plates in the column with reference to the isotopes of B and Cl was the same, the separation factor (SF) between the liquid BCl_3 and its vapor with reference to the Cl isotopes is equal to 1.001, if the SF with reference to the B isotopes was equal to 1.004. Molecules of $B^{11}Cl^{35}$ possess the greatest volatility, and those of $B^{10}Cl^{37}$ possess the least.

Mass Spectrography

Refer also to abstract 8994.

9300 CEA-692

France. Commissariat à l'Énergie Atomique, Paris. MULTIPLICATEUR D'ÉLECTRONS POUR LA MESURE DE COURANTS D'IONS SUR UN SPECTROMÈTRE DE MASSE. (Electron Multiplier for the Measurement of an Ion Current on a Mass Spectrometer.) P. Lobez and G. Nief. Sept. 4, 1957. 25p.

The apparatus described is designed to measure weak ion currents received at the collector of a mass spectrometer. The report describes successively the study of electron paths in the multiplier by the method of analogy, using rubber membranes, and the practical details of construction of the apparatus. The variation with surface treatment of the secondary emission coefficient of the alloy CuBe containing 2 per cent Be, which makes up the dynodes, and the influence of the voltage on the gain per stage, are discussed. Results of tests regarding: the influence of the ion mass on the gain, the background of the instrument, and the energy distribution of the impulses coming out on a high gain multiplier (q.q. 10^7) are given. Finally the performances of the multiplier are reported. For a low gain (10^4), precision and reproducibility comparable to the electrometer valve, sensitivity 100 times greater, currents capable of detection 10^{-17} ampere are obtained. For a high gain (10^7) and measurement by impulse counting, currents capable of detection 10^{-19} ampere are obtained. (auth)

9301

A METHOD FOR THE MASS SPECTROMETRIC ISOTOPIC ANALYSIS OF Mg, Zn, AND Cd USING REDUCTION OF OXIDES BY CHARCOAL IN THE ION SOURCE FURNACE. Dragutin D. Gvozdanović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 151-5(1958) Mar.

A new mass spectrometric method for the isotopic analysis of magnesium, zinc, and cadmium was developed. Instead of the evaporation of the metal or any compound, metallic vapor was obtained by reduction of oxides by means of charcoal in an ion source furnace. By this method a stable and intensive ion current is obtainable and the manipulation of the sample is simplified. For these analyses fractions of a milligram only are necessary. (auth)

9302

A MASS-SPECTROMETER FOR THE INVESTIGATION OF PROCESSES OCCURRING DURING THE COLLISION OF ELECTRONS AND IONS WITH MOLECULES. Ye. L. Frankevich and V. L. Tal'roze. Pribory i Tek. Ekspt. No. 2, 48-53(1957).

The method of electron bombardment is one of the most important for determining the ionization potentials and binding energies in molecules. The effect of the electron energy spread in spectrometers as used in such measurements may be compensated by the so called method of "quasimonochromatization" of electrons as proposed by Fox et al. In the present article a mass spectrometer is described which can measure accurately the ionization potentials and the initial ion energy by using the method of retarding potentials. The ionizing electrons are made quasimonochromatic by the introduction into the electron gun of a retarding electrode, the potential of which is modulated by a small amplitude alternating voltage at 10 kc/s, and the ion current is amplified by a resonant amplifier tuned to the same frequency. A detailed description of the instrument is given, together with the circuit of the associated pulse generator, of the ionizing voltage

supplies, and of the high voltage stabilized sources. Results, in the form of graphs, are given for the incidence of molecular ions of NH_3^+, H_2S^+, $C_3H_8^+$, $C_2H_2^+$, H_2O^+, and H_3O^+ occurring during various secondary processes. (TCO)

Mathematics

9303 SCTM-169-58(51)
Sandia Corp., Albuquerque, N. Mex.
DISTRIBUTION OF A QUADRATIC FUNCTION OF A SINGLE VARIABLE. E. J. Gilbert. Apr. 30, 1958. 6p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

A method is given for finding the distribution of a quadratic function of X when the distribution of X is known. (auth)

9304
SOME EXPERIENCES WITH A REPETITIVE DIFFERENTIAL ANALYSER. R. Tomović and D. Mitrović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 109-16 (1958) Mar.

Experience with a repetitive differential analyzer incorporating some new design features is described. The operation of such analyzers have been greatly facilitated by adding to the conventional cathode-ray tube oscilloscope a simple electronic system to measure instantaneous values of periodic voltage wavefronts. Research has also shown that it is feasible to build the whole linear part of the analyzer around a single and simple element. Further improvements of this idea, such as complete elimination of the effects of time constant of the memory circuit upon the output of the function generator, or the use of transistors and magnetic materials as design elements are possible. In this way it is hoped to arrive at a simple and inexpensive general purpose electronic differential analyzer serving as a research tool in both linear and non-linear synthesis problems. (auth)

9305
SIMPLE EXPANSION FOR THE REGULAR COULOMB WAVE FUNCTION. A. S. Meligy (Univ. of Alexandria, Egypt). Nuclear Phys. 6, 440-2(1958) Apr. (1).

The procedure employed by Shepanski and Butler for the expansion of the regular radial Coulomb wave function has been modified, leading to a simple expansion of the same rapidity of convergence. (auth)

9306
AN ITERATIVE METHOD FOR SOLVING THE P_1 EQUATIONS IN SLAB GEOMETRY. E. Gelbard (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 3, 468-9(1958) Apr.

The few-group diffusion codes programmed for various machines are inadequate for classes of problems requiring higher approximations to the transport equation. It is possible, however, to do one-velocity P_3 or double-P_1 problems, in slab geometry, with the aid of a slightly modified diffusion code. This diffusion code is discussed. (A.C.)

9307
FERMI COORDINATES. L. O. Raifeartaigh (Dublin Inst. for Advanced Studies). Proc. Roy. Irish Acad. 59, Sect. A, No. 2, 15-24(1958) Mar.

Schouten and Struik have discussed Fermi coordinates for a subspace U_M ($M \geq 1$) immersed in a space V_N with symmetric affine connection Γ^i_{jk}. The present paper completes their treatment by giving an invariant necessary and sufficient condition for the existence of Fermi coördinates, and a more explicit treatment of their geometrical construction. In view of the physical importance of Fermi coordinates in connection with the vanishing of the energy pseudo-tensor, the theory is given in detail. (auth)

Measuring Instruments and Techniques

Refer also to abstracts 8982, 9030, 9034, and 9559.

9308 ARL/R1/R424
Gt. Brit. Admiralty Research Lab., Teddington, Middx., England.
THE ACCURACY OF INTEGRATING ION CHAMBERS FOR THE MEASUREMENT OF GAMMA RADIATION. B. W. Soole. Mar. 7, 1952. 12p. (ACSIL/ADM/52/237).

A statistical analysis of measurements made with 94 pocket ionization chambers, Type B.D.11 as developed by the Medical Research Council for personnel protection, shows that the chambers are reliable and consistent in use and are capable of making comparative measurements of ionization to an accuracy comparable with that afforded by N.P.L. standardization. (auth)

9309 USNRDL-TR-224
Naval Radiological Defense Lab., San Francisco.
A SIMPLIFIED FILM DOSIMETER FOR FISSION NEUTRONS. S. W. Ross and E. Tochilin. Apr. 4, 1958. 24p.

A film dosimeter technique was developed for fast neutron monitoring of reactor personnel. The method takes advantage of the rapid build-up of thermal neutrons when fast neutrons are allowed to penetrate a hydrogenous moderator. The badge consists of a $\frac{3}{4}$-inch thick polyethylene frontpiece that is worn on the belt against the body. A combination of silver and tin filters are matched so as to produce equal film blackening from either x or gamma rays. Fast neutron exposure is determined from film blackening under radioactive silver produced by capture of the moderated neutrons. The badge contains a sensitive gamma-ray dosimeter film together with a nuclear track emulsion. The dosimeter film serves as both a fast neutron and gamma-ray dosimeter. The nuclear emulsion is read whenever an overexposure is indicated or under any other conditions where a more accurate evaluation of the fast neutron dose is warranted. (auth)

9310 WT-1190
Federal Civil Defense Administration, Battle Creek, Mich.
EVALUATION OF CIVIL DEFENSE RADIOLOGICAL DEFENSE INSTRUMENTS. John H. Tolan. Apr. 1957. 57p. Project 38.3 [of] OPERATION TEAPOT. $1.75(OTS).

Experiments were performed during Operation Teapot (1) to investigate the beta-gamma exposure-rate ratio from fall-out to establish design criteria for high-range survey instruments, (2) to evaluate commercial radiological defense instruments, and (3) to investigate the feasibility of the use of commercial and amateur roll film and dental x-ray film as indicators of prompt gamma radiation. The results of the beta-gamma exposure-rate ratio measurements indicate that, for an instrument having a beta window of the order of 50 mg/cm^2 thickness, the quantity of hazardous radiation not indicated by the instrument will not exceed a factor of 2. This factor is not constant with time postshot, nor would it be expected to be constant with fall-out over different types of ground surface, but it does indicate a magnitude to be expected and will serve as a basis for comparison of data collected in future test operations. An analysis of the absorption data of fission-product radiation indicates the presence of high-energy beta radiation, low-energy gamma radiation, and secondary x radiation in large quantities immediately postshot. The soft component tends to diminish rapidly, and the high-energy gamma radiation of the longer-lived fission products becomes predominant after approximately 2 days. The evaluation of commercial radiological defense instruments indicated that (1) satisfactory calibration facilities for this type of instrument must be developed, (2) ionization-

chamber survey meters must have sealed chambers to avoid change in sensitivity with altitude, (3) an operational check rather than a simple battery check must be provided for all survey meters, and (4) dosimeters intended for monitoring applications must not demonstrate leakage resulting from high initial exposure and must be relatively insensitive to beta contamination. Experiments performed to investigate the feasibility of the use of commercial and amateur roll film and dental x-ray film as indicators of prompt gamma radiation indicated that (1) commercial and amateur roll film can be used as prompt radiation dosimeters provided that the accuracy requirements are not too rigid and (2) dental film exposed to the prompt radiation gives a roughly satisfactory result whether or not special filters to reduce energy dependence are used. (auth)

9311

RADIOACTIVITY OF THE HUMAN BODY. F. W. Spiers and P. R. J. Burch (Univ. of Leeds, Eng.). Advances in Biol. and Med. Phys. 5, 425-57(1957).

Although it is not yet possible to assess the biological role of natural radioactivity in human life, it is important to determine its magnitude before any substantial change takes place in its level due to acquired radioactivity. Various techniques for measuring natural body radioactivity are reviewed. The low-level activities encountered require that the radiation detector should combine high sensitivity and stability with a low background. Techniques are described and results presented from measurements of gamma radiation emitted from living subjects; measurements of radioactivity in breath, urine, feces, and ashed specimens; particle tracts in autoradiographs of tissues; determination of potassium-40, radium, and carbon-14 content of body tissues; dosage to body tissues from natural radioactivity; and a comparison of dosage from acquired body radioactivity with that from natural background. (72 references.) (C.H.)

9312

LIGHT BEAM TRIANGULATOR FOR MEASURING THYROID-COUNTER DISTANCES IN RADIOIODINE UPTAKE STUDIES. Arthur L. Dunn and William G. Beran (Veterans Administration Hospital, Omaha). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 999-1000 (1958) June.

A light beam triangulator has been constructed which allows for maintaining a constant counter-to-patient distance during thyroid radioiodine uptake studies without resorting to metal or plastic rods or lengths of chain. The advantages of this method over former techniques used are that the patient may be in a standing, sitting or supine position; no protrusions from the counter are necessary; distance may be repeatedly checked throughout the procedure; resetting of mirrors for any counter-patient distance can be accomplished quickly and checked with a meter rule; and the cost is minimal. (auth)

9313

THE INTENSITY DETERMINATION OF VERY SHORT PULSES OF FAST NEUTRONS. V. M. Gorbachev and Yu. S. Zamyatnyn. Atomnaya Energiya 3, No. 8, 101-5 (1957).

By use of the "contraction method," the neutron yield is measured by the γ quanta formed by neutron capture in paraffin. On the photocathode of a multiplier there is a crystal with Ø of 35 mm, H = 20 mm, which is surrounded by a cadmium hood on its upper part. The entire head of the multiplier is surrounded by a paraffin cylinder (Ø = 130 mm, H = 150 mm) which, in turn, is enclosed by a thin lead cylinder. By this arrangement time measurements of 100 to 300 μs become adequate instead of the pulse times of 0.1 to 1.0 μs, because the average life of slow neutrons in paraffin amounts to only about 200 μs. The pulses of the photomultiplier are led to an amplifier ($< 3.10^6$ Hz) and from there to the cathode of the cathode-ray oscillograph, the deviation of which on the screen gives a spiral-shaped image. By the pulse from the multiplier the deviation is interrupted, and the black spots on the oscillogram then correspond to the number of neutrons. The relative effectivity of the various crystals was measured and the following values were obtained: Stilbene, 1.00; naphthaline, 1.16; NaI, 2.60; and CsI, 4.12. If several of the systems described are connected in parallel, a sensitivity of 0.05 to 0.1 neutron per cm^2 can be attained. (TCO)

9314

A SLOW NEUTRON DETECTOR. T. V. Timofeyeva. Atomnaya Energiya 3, No. 8, 156-7(1957).

If a scintillator which is responsive to neutrons is produced in such a manner that the light carrier is melted with boron, this device is considerably more sensitive with respect to the detection of neutrons than those produced by the two methods hitherto employed. By the new method a flat- and a hollow-cylinder scintillator was produced from zinc sulfide activated by silver and boric acid. Its light spectrum has a maximum at 4430 A. The recording sensitivity with respect to neutrons depends to a considerable extent on the thickness of the scintillator and the size of grain. The optimum thickness is attained at about two to three grain sizes. The sensitivity of the scintillator described in the case of fast neutrons is only 1/100 of that it possesses with respect to slow neutrons. (TCO)

9315

ON THE USE OF SCINTILLATION COUNTER FOR DOSIMETRY. I. B. Keyrim-Markus and Z. P. Lisitsyna. Atomnaya Energiya 3, No. 8, 157-61(1957).

The use of a scintillator with a connected multiplier in dosimetric devices is to be recommended. TheRussian multipliers FEU-19 and FEU-25 can be used successfully for such dosimeters only if it is possible, by some means, to obtain easily a stabilization of voltage. The scheme with the corresponding resistance and voltage values is given. In the case of main voltage fluctuations of +10% to −15% the multiplication coefficient remains unchanged (up to ±1%) if this so-called self stabilization is employed. In order to compensate somewhat for the disadvantage of the small photocathode of Russian multipliers, a cone-shaped light conductor, which consists of several cones telescoped into one another, is used. (TCO)

9316

MEASURING THE ABSOLUTE NEUTRON SOURCE INTENSITY BY COMPARISON WITH THE $T(d,n)He^4$-REACTION. N. N. Flerov and V. M. Talyzin. Atomnaya Energiya 3, No. 10, 291-7(1957).

For determining the absolute intensity of a neutron source the intensity of the neutrons form the $T(d,n)He^4$ reaction are compared by determination of the absolute number of α particles. For the purpose of comparing neutron intensities a graphite square block is used in which a constant neutron sensitivity is proved to prevail which, within a wide domain, is independent of the initial neutron energy. The sensitivity of the graphite detector is reproducible within 1 to 2% for the initial energy range of the neutrons of from 0.1 to 8 Mev. The intensity of the Ra−α−Be source H^{28} was determined at $(4.78 \pm 0.18) \times 10^5$ n/sec. The intensity of the Ra−γ−Be source H^{29}, connected with the intensity measuring of H^{28}, results in $(3.73 \pm 0.14) \times 10^5$ n/sec. For the source H^{29} the neutron intensity was determined at $(4.86 \pm 0.19) \times 10^5$ n/sec. The results given agree well with other measurements, especially with the Swedish comparative measurements. (TCO)

9317

THE OPERATION OF GAS DISCHARGE COUNTERS UNDER CONTROLLED PULSED VOLTAGE CONDITIONS. V. V. Vishnyakov and A. A. Tyapkin. Atomnaya Energiya 3, No. 10, 298-307(1957).

The counting errors caused by the dead time of the counter can be eliminated in the case of pulse-like feeding of gas discharge counters. The counting characteristics, effectivity, and dissolving capacity of argon-methylal counting tubes MC-6, MC-7, MC-9 and the halide counting tube CTC were determined for pulse-like feeding. It was found that with short-time feeding (duration of pulse $\sim 10^{-6}$ sec) the counting tubes are still able to work at overvoltages of up to 2 kv. If this fact is taken advantage of for a hodoscope (telescope), the pulses coming from the counting tube need not be amplified, and no coincidence with control pulses is necessary. Each channel of the hodoscope, with the exception of the counting tube, switches on only the load resistance and a neon signal lamp. Thus a considerable simplification of the construction as well as reliability of operation is warranted. (TCO)

9318

SUBTHRESHOLD IONIZATION LOSSES IN FAST-NEUTRON IONIZATION-PULSE DOSIMETERS. Yu. I. Petrov. Atomnaya Energiya 3, No. 10, 326-7(1957).

By means of a proportional counting tube it is possible, when measuring neutron doses, to eliminate the γ background (according to Hurst). The most essential disadvantage of this method is caused by the uncontrollable ionization losses (below the threshold value). These are measured accurately for the case when the recoil protons penetrate from a thick radiator into a small gaseous slit which always takes place on the occasion of the impinging of neutrons onto the surface of the radiator. It is shown that, if the threshold value is 0.1 Mev, the thickness of the gaseous slit is 1 cm and the energy of the neutrons to be recorded amounts to 3 Mev, the ionization losses amount to 31%, while Hurst estimates them only at $\sim$ 0.1%. (TCO)

9319

COMPARISON BETWEEN USSR AND SWEDISH NEUTRON STANDARDS. G. A. Dorofeyev, I. Ye. Kutikov, and A. M. Kucher. Atomnaya Energiya 3, No. 10, 328-30(1957).

The Russian neutron standard source H_{26} was measured in 1952 at $(4.70 \pm 0.30) \times 10^5$ n/sec, and the source H_{22} was measured in 1951 at $(5.96 \pm 0.17) \times 10^5$ n/sec. The Swedish neutron standard source Q_1 was measured in 1952 and 1954 by Larson at $(2.65 \pm 0.05) \times 10^6$ n/sec. On the occasion of Larson's visit to Moscow the three sources were compared with one another and $Q_1/Q_{H22} = 0.439 \pm 0.5\%$ and $Q_{H26}/Q_{H22} = 0.082 \pm 0.5\%$ was measured. If in addition the time factor is taken into account, the three sources have (for 1957) the value: $Q_{H26} = 6.07 \times 10^6$ n/sec, $Q_{H22} = 4.82 \times 10^5$ n/sec, and $Q_1 = (2.86 \pm 0.06) \times 10^6$ n/sec. (TCO)

9320

α-PARTICLE INDUCED SCINTILLATIONS IN HIGH-PRESSURE HELIUM. S. A. Baldin, V. V. Gavrilovskiy, and F. Ye. Chukreyev. Atomnaya Energiya 3, No. 10, 331-4(1957).

The scintillations were investigated in an attempt to find a sufficiently effective method of establishing the polarization degree of a neutron beam of 2 to 20 Mev. This method is based upon the registration of the coincidences between the scattered neutrons and the recoil nuclei in the gas scintillation chamber filled with pure helium at 10 atm. pressure. The dependence of the counting velocity upon pressure of the various gas mixtures (pure He, He + Xe, He + Ar, He + O_2, He + N_2) was measured, and the corresponding curves are shown. (TCO)

9321

COMPUTATION AND MEASURING OF THE γ-FIELD OF A PLANE SOURCE. U. Ya. Margulis and A. V. Khrustalev. Atomnaya Energiya 3, No. 10, 338-41(1957).

The equations for the calculation of the dose of a plane source are derived theoretically, and the isodose curves are formed. Measurement of the dose on a quasi-plane source of 418 mc (11 adjoining, active rods of a length of 1 m) is described. It is shown that an apparatus with a source consisting of 2 parallel plates with a distance of 25.44 cm and a total activity of Q = 1000 milligram radium equivalent possesses an efficiency of 35.616 kg radium equivalent, where in the center of both plates there is a dose of 0.21 r/min. If, however, an apparatus is used for which an equivalent, cylindrical source of equal strength is used (25.44 cm, length 100 cm), then only an efficiency of 16.18 kg radium equivalent exists, where in the center of the source there is a dose of 0.291 r/min. (TCO)

9322

PREPARATION OF "NUCLEAR" PHOTOGRAPHIC EMULSIONS STARTING WITH COLLOIDAL SILVER. Max Morand, Jean Colomer, and Christiane Schoebel. Compt. rend. 246, 1847-9(1958) Mar. 24. (In French)

Preliminary results are given on the preparation of nuclear emulsions by bromination of the colloidal silver and sensitivation of the crystals. (tr-auth)

9323

EFFECT OF THE FLUCTUATIONS OF THE SPECIFIC LOSS OF ENERGY ON THE GRANULATION IN THE REGION OF THE IONIZATION MINIMUM. Max Morand, Marie-Cécile Le Gentil, and Simone Desprez-Rebaud. Compt. rend. 246, 1991-2(1958) Mar. 31. (In French)

A theoretical determination is made of the distribution of sensitivity of the AgBr crystals in the Kodak NT4 nuclear emulsions, by considering the fluctuation of the specific loss of energy. A particular study is made of the case where I is approximately I_0. (tr.auth)

9324

C^{14} RADIOACTIVITY MEASUREMENT METHODS. G. Giustina and E. Lazzarini. Energia nucleare (Milan) 5, 229-45(1958) Apr. (In Italian)

The C^{14} counting methods are described and discussed. Details are given for each of them about their use and limitations. (auth)

9325

THE INTENSITY OF GAMMA RADIATION EMITTED BY A CYLINDRICAL SOURCE. E. E. Kovalev. Intern. J. Appl. Radiation and Isotopes 3, 113-18(1958).

The intensity of γ-radiation emitted by a cylindrical source is calculated both with and without allowance for self-absorption. An analytical expression involving only tabulated functions is obtained for the radiation yield from a non-absorbing cylinder in the radial direction. It may be applied to sources having appreciable self-absorption by the inclusion of a factor calculated in the second part of the paper. This self-absorption factor is tabulated for various absorption coefficients and for cylindrical sources of different height to diameter ratio. (auth)

9326

SOME FURTHER STUDIES ON THE APPLICATION OF METHYLENE BLUE IN AQUEOUS SOLUTION AS A DOSIMETER FOR INTENSE BEAMS OF HIGH-ENERGY RADIATION. B. Lafuente, S. A. Goldblith, and B. E. Proctor (Massachusetts Inst. of Tech., Cambridge). Intern. J. Appl. Radiation and Isotopes 3, 119-24(1958).

Aqueous solutions of methylene blue sealed in glass ampoules have been exposed to γ-radiation, stored at

different temperatures and checked periodically for dye retention for a period of 2 months. The results obtained show that the dye destruction proceeds after irradiation and at a rate dependent on the storage temperature. Parallel tests conducted with non-irradiated samples show small losses of dye, of the order of the experimental error. Another set of experiments using electron beams revealed no practical differences in the extent of dye destruction when the temperature during the irradiation process was varied from 45 to 150°F. Some practical recommendations are given in order to attain a good degree of reproducibility when using the methylene blue as a radiation dosimeter. (auth)

9327

ENERGY DEPENDENCE OF SILVER PHOSPHATE GLASS DOSIMETERS. A. L. Riegert and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon, Can.). Intern. J. Appl. Radiation and Isotopes 3, 125-30(1958).

The responses of three types of silver phosphate glass dosimeter to x and γ radiation show a small energy dependence effect over the energy region, 1.26 to 24 Mev. Dosimeters in the form of thin glass plates exhibit a greater response to low energy x rays. Increasing the size of the glass element reduces this energy dependence. Other investigators have found that by placing suitable lead filters about the glass, the response of the dosimeters was reasonably energy independent over the range 100 kev to 1 Mev. It has, however been found that the lead filters cause phosphate glass dosimeters to show a high response to x rays of several Mev in energy. (auth)

9328

TWO-CHANNEL GAMMA COUNTING OF Cr^{51} AND I^{131}. R. Adams, I. C. Woodward, M. G. Crane, and J. E. Holloway (College of Medical Evangelists, Los Angeles). Intern. J. Appl. Radiation and Isotopes 3, 156-60(1958).

Red blood cells are easily labelled with Cr^{51} and blood plasma is readily tagged with I^{131}. However, the proximity of the principal gamma energies of these two isotopes complicates the use of differential pulse height analysis techniques for the measurement of doubly labelled blood. Instrumentation for accomplishing this procedure includes a 3 in. well-type scintillation counter operated with two singel-channel differential pulse height analyzers. A method is presented for setting up two channels with the analyzers to obtain adequate separation of Cr^{51} and I^{131}. A simple correction for the cross-channel activities is shown. The accuracy of the method is evaluated by the assay of mixed Cr^{51} + I^{131} sources prepared gravimetrically. (auth)

9329

ROLE OF PHOTONS IN ARGON–ALCOHOL COUNTERS. P. Mortier, J. Demuynck, and O. Segaert (Rijksuniversiteit, Ghent, Belgium). Nature 181, 1327-8(1958) May 10.

The experiment performed contradicts the assumption that the velocity of the discharge propagation in a Geiger tube is determined by the photo-electric effects at the cathode and not by the photo-ionization of the gas near the anode. The counter used had three aluminum cathodes 1.5 cm diam. with lengths 3 cm, 10 cm, and 3 cm, held at a mutual distance of 0.2 mm. The anode was a central molybdenum wire, diameter 0.08 mm. (W.D.M.)

9330

USE OF $Li^6I(Eu)$ AS A SCINTILLATION DETECTOR AND SPECTROMETER FOR FAST NEUTRONS. R. B. Murray (Oak Ridge National Lab., Tenn.). Nuclear Instr. 2, 237-48 (1958) Apr.

The scintillation response of europium-activated crystals of Li^6I to neutrons in the energy range 1 to 14 Mev has been investigated with the crystals maintained at various temperatures. The pulse-height spectrum from monoenergetic neutrons incident on a crystal at room temperature demonstrates a poorly defined and broad fast-neutron peak. Upon cooling the crystal, the fast-neutron peak becomes sharper and assumes a nearly Gaussian shape at temperatures below about –140°C. This behavior is attributed to an increased scintillation efficiency of LiI(Eu) to alpha particles at low temperatures. Pulse-height spectra from crystals at the liquid nitrogen point are presented for neutrons from the $D(d,n)He^3$, $T(d,n)He^4$, and $Be^9(d,n)B^{10}$ reactions, a Po-Be source, and U^{235} fission. The principal features of $Li^6I(Eu)$ as a fast-neutron spectrometer are a relatively high detection efficiency (≈0.1%) and moderate resolution. (auth)

9331

ON THE PULSE SHAPE IN A CYLINDRICAL IONIZATION CHAMBER. C. Cernigoi, G. Pauli, and C. Poiani (Instituto di Fisica dell'Universitá and Istituto Nazionale di Fisica Nucleare, Trieste, Italy). Nuclear Instr. 2, 261-9(1958) Apr.

A fast ionization chamber, 60 l in volume filled with argon at 10 atm, is described. The pulse shapes are calculated assuming the ionization: (a) confined to an infinitesimal volume of the chamber, (b) distributed along a straight line parallel to the axis of the chamber, (c) distributed along along a straight line passing through the axis of the chamber and perpendicular to it, (d) distributed along a straight line perpendicular to the axis of the chamber and not passing through it, (e) distributed throughout the volume of the chamber. A comparison is made between the theoretical pulse shapes and the experimental ones. (auth)

9332

APPARATUS FOR PROCESSING NUCLEAR EMULSIONS. E. Bujdosó and L. Medveczky (Inst. of Nuclear Research of the Hungarian Academy of Science, Debrecen). Nuclear Instr. 2, 270-4(1958) Apr.

An apparatus was built for processing nuclear emulsions. Its functioning is shown by describing the processing of an Agfa K2 emulsion of 200 μ thickness. (auth)

9333

AUTOMATIC-RECORDING APPARATUS FOR FISSION-FRAGMENT TIME-OF-FLIGHT MEASUREMENTS. J. S. Fraser and J. C. D. Milton (Atomic Energy of Canada, Ltd., Chalk River, Ont., Can.). Nuclear Instr. 2, 275-81 (1958) Apr.

An apparatus has been constructed to measure the velocities of both members of a fission-fragment pair. A zero-time signal is obtained at the expense of about one per cent of the fragment energy by detecting delta rays ejected by the fragment from a thin plastic foil placed near the source. The fragment times of flight are converted to pulse heights for analysis. An over-all time resolution of 3.5 mμsec is obtained. A third variable, e.g. gamma-ray energy or prompt neutron time of flight, may also be recorded, the three pulse heights being punched consecutively on paper tape. Three-dimensional analysis is therefore possible but in practice sorting is done taking two variables at a time. (auth)

9334

PHOTOLUMINESCENT CHARACTERISTICS AND RELATIVE SCINTILLATION INTENSITIES OF PLASTIC SCINTILLATORS WITH ANTHRACENE DERIVATIVES. A. S. Cherkasov, G. A. Tishchenko, and K. G. Voldaikina (Vavilov State Inst. of Optics). Optika i Spektroscopiya 4, 345-7(1958) Mar. (In Russian)

The relation between the relative scintillation intensities of plastic scintillators with anthracene derivatives and photoluminescence characteristics was investigated. It is

shown that scintillators with the anthracene mesoaryl derivatives have the highest quantum yields of luminescence. (tr-auth)

9335

ON THE FORMATION AND ACTION OF THE TRAPPING LEVELS OF ZnS–Mn PHOSPHORS. V. L. Levshcin and B. D. Ryzhikov (Moscow State Univ.). Optika i Spektroscopiya 4, 358-64(1958) Mar. (In Russian)

It is shown that on the thermal luminescence curves of ZnS–Mn phosphors the positions of the first and second maximum curves for the blue luminescence are slightly closer at lower temperatures than those of the orange luminescence. The investigation indicates the strong contrast in the kinetics of the blue and orange luminescence. The distributions of manganese ions follow a certain order in which the first portions of the introduced activator are distributed near the defective lattice location while the successive ones replace the ions of zinc in the lattice point. (R.V.J.)

9336

MEASUREMENT OF THE PROTON ENERGY SPECTRUM IN THE DEFLECTED BEAM OF A 1.5m CONSTANT FREQUENCY CYCLOTRON. L. M. Nemenov, Yu. M. Pustovoyt, and N. D. Fedorov. Pribory i Tek. Ekspt. No. 2, 24-6(1957).

The deflected proton beam of a cyclotron has a well defined energy inhomogeneity. Results are given of measurements of the mean energy distribution across the deflected beam. Protons were obtained from the acceleration of hydrogen ions. The mean proton energy was determined from range measurements in aluminum. The instrument consisted of a collimator, with 3 mm diameter apertures, placed on a special chassis. The collimator was insulated and had separate electrical connectors. Two drums were placed behind the collimator, revolving independently of each other with respect to one axis. The drums had eight apertures each 8 mm in diameter, with filters of various thickness in seven of the apertures. Both drums were electrically coupled and had a common insulated input. The two windows which had no filters, one for each drum, were used to measure the full proton beam. Two methods of measurement of the mean ranges of protons in aluminum were used: in the first a variable thickness filter made of aluminum foil was placed across the beam path and the absorption curve was measured, giving the relationship between the number of protons hitting the collector and the thickness of the filter. The mean range could then be determined from the filter thickness at which the collector current was halved. In the second method no collimator foil was used so that the ion splitting of the molecular hydrogen was occurring at the aluminum filter of the first drum. The electron thus liberated was absorbed by the foil. Assuming the foil to be so thin as not to absorb the protons, its current could be assumed to be purely an electron one and equal to half the proton current at the collector. Measurements have shown that the mean proton energy across the beam increases by approximately 3.5%. (TCO)

9337

AN APPLICATION OF THE DIFFUSION CHAMBER TO THE DETERMINATION OF SMALL ACTIVITIES. V. K. Lyapidevskiy. Pribory i Tek. Ekspt. No. 2, 37-9(1957).

The difficulties in determining small activities when using particle counters may, to a large extent, be avoided by using the diffusion chamber for recording radiation. Results of measurements of α activity using a diffusion chamber are given. Two methods are described: in one the sample is at the bottom of the chamber, in the second it is placed in the region where supersaturation is less than unity. It is shown that by using the first method both the absolute sample activity and the vapor stream may be determined; the second method permits the determination of activities of the order of 10^{-12} curies both for α and β preparations. A formula for the evaluation of the particle stream with the camera in a stationary regime is given. (TCO)

9338

A NEUTRON FLUX METER. L. A. Matalin and A. A. Ivanov. Pribory i Tek. Ekspt. No. 2, 77-8(1957).

A new method of measuring a flux of thermal neutrons in the presence of γ radiation based on the modulation of the neutron beam is described. The method is insensitive to gamma radiation. It consists of placing between the neutron and gamma source and the sensing chamber an arrangement which modulates the thermal neutron beam with a pre-determined frequency. The modulated neutron beam provides the a-c component of the chamber while the gamma radiation provides its d-c component. The a-c component is amplified by a selective (LC) amplifier. The modulator is a system of two concentric hollow cadmium cylinders. The sensing chamber is placed inside the inner, stationary cylinder. Each cylinder has a similar number of windows placed along the sensitive wall of the chamber. Since, with the rotation of the external cylinder some modulation of gamma radiation is present, it is suppressed by placing windows in this cylinder, which attenuate the gamma radiation in the same degree as the cylinder walls. Because of the small currents the amplifier as used with the meter is of an electrometer type. The minimum sensitivity obtained with an experimental instrument was 10 n/cm^2-sec in a first approximation, and no gamma modulation was observed with gamma radiation flux of the order of 5×10^{11} γ/cm^2-sec. (TCO)

9339

CONCERNING SOME CHARACTERISTICS OF SPARK COUNTERS USED IN THE RECORDING OF α-PARTICLES. Ye. Andreyeshchev and B. M. Isayev. Zhur. Eksptl'. i Teoret. Fiz. 28, No. 3, 335-42(1955). (Translated from Referat. Zhur. Khim. No. 3, 1957, abstract no. 8696).

It is shown that a constant corona discharge leads to the self-stabilization of spark counters. The change in counter characteristics as a function of the distance between the electrodes and of the humidity has been investigated. It is shown that the efficiency of the counter increases with increasing humidity.

9340

METHOD OF MEASURING THE ENERGY OF PARTICLES IN THE RANGE HIGHER THAN 10^{11} ev. N. L. Grigorov, V. S. Murzin, and I. D. Rapoport (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 506-7(1958) Feb. (In Russian)

The design and performance of an apparatus for the determination of the energy of an individual nuclear active particle are outlined. The principle of the instrument is based on the measurements of the total energy released by the secondary particles which formed during the passage of the initial particle through a thick layer of a substance. Experimental data obtained with such an apparatus at 3860 m above sea level are included. (R.V.J.)

Mesons

9341 NP-tr-78

MESONIC ATOMS. D. D. Ivanenko and G. E. Pustovalov. Translated from Uspekhi Fiz. Nauk 61, 27-43(1957). 20p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 5999.

9342
NEW RESULTS IN THE STUDY OF THE DISINTEGRATION CHAIN $\pi^+ - \mu^+ - e^+$. Horia Hulubei, Josef Ausländer, Elena Balea, Erwin Friedländer, and Şerban Ţiţeica. Compt. rend. 246, 2197-2200(1958) Apr. 14. (In French)

Nuclear emulsions were exposed to π^+ mesons with an initial energy of 307 Mev. Some 7526 disintegrations $\pi \rightarrow \mu \rightarrow e$ were studied. From this data, it was concluded that the distribution of the (π,μ) angle is anisotropic. The distribution of the (μ,e) angle depends on the (π,μ) angle. The coefficients of forward-backward asymmetry do not represent a complete characteristic of an eventual anisotropy. The direction of incidence of the μ^+ mesons appear as a privileged direction in space. It then seems possible to attribute to π^+ a spatial property which makes them capable of some polarization, It is plausible to say that the conditions of generation of the π^+ mesons should play a certain role in the evolution of the chain. (J.S.R.)

9343
ROLE OF PION-PION INTERACTION IN τ-DECAY. A. N. Mitra (Muslim Univ., Aligarh, U.P., India). Nuclear Phys. 6, 404-19(1958) Apr. (1).

The effect of the pion-pion interaction on the anisotropy of the decay pions in τ decay and on the τ'/τ branching ratio is studied, following the formalism of a recent paper by Dalitz. The $\pi-\pi$ interaction is assumed to be of the resonant Breit Wigner type in the isobaric spin states $I = 0$ and $I = 2$. It is found that the assumption of an $I = 2$ resonance can satisfactorily explain the experimental figures for the momentum distribution of the negative pion as well as the τ'/τ branching ratio. This result serves as a supporting evidence for a recent deduction by the author of an $I = 2$ resonance within the framework of the pseudoscalar meson theory. (auth)

9344
A TENTATIVE UNIFIED CLASSIFICATION OF ELEMENTARY PARTICLES, INCLUDING LEPTONS. V. I. Goldanski Goldanski (P. N. Lebedev Physical Inst., of the USSR Academy of Sciences, Moscow). Nuclear Phys. 6, 531-8 (1958) Apr. (1).

A unified classification of all families of elementary particles, that is, of baryons, Bose mesons, and light fermions (leptons: μ, e, ν) is proposed. The classification is based on extension of the isobaric multiplet principle to leptons. One of the corollaries of the scheme is that the six leptons known at present are the only ones that may exist. In weak interactions leading to the production of leptons the change of the 3-projection of the isobaric spin is $\Delta T_3 = 0, \pm\frac{1}{2}$. When viewed from this angle the values of ΔT_3 in various ways of hyperon β-decay indicate that many different modes of decay are possible, excepting a few cases that are specially mentioned. The selection rules for T_3 are not sufficient to explain the absence of weak interactions involving formation of various electrically neutral lepton pairs. The absence of such interactions can be explained by introducing for leptons a certain number $N = Q - \frac{1}{2}m$ (Q = electric charge, m = neutrino charge) and postulating the selection rule $\Delta N = \pm 1$ for weak interactions involving lepton production. (auth)

9345
THEORY OF MESON MULTIPLE PRODUCTION. D. Iiō and H. Tanaka (Tokyo Univ. of Education and Univ. of Bologna). Nuovo cimento (10) 7, 91-116(1958).

A theory of multiple meson production is formulated in a way to clarify the field theoretical meaning of the Fermi and Landau theories. The general structure of the S-matrices for multiple production is discussed from the statistical point of view, and as a special case the perfect gas model is obtained where the correspondence with the original Fermi theory becomes clear. The imperfect gas model is referred to briefly. The hydrodynamical behavior of the meson field is derived in which the starting equations of the Landau theory are obtained. Some comments on the Landau theory are given concerning the initial condition which plays an important role in determining the character of the meson fluid. A simpler model, based on a statistical field theory, is shown to give good agreement with the recent experiments. (W.D.M.)

9346
ASYMMETRY IN THE ANGULAR DISTRIBUTION OF $\mu^+ \rightarrow e^+$ DECAY ELECTRONS OBSERVED IN PHOTOGRAPHIC EMULSIONS. I. I. Gurevich, V. M. Kutukova, A. P. Mishakova, B. A. Nikol'skii, and L. V. Surkova (Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 280-5(1958) Feb. (In Russian)

Results of measurement of the angular distributions of $\pi \rightarrow \mu \rightarrow e$ decay electrons observed in a photographic emulsion located within a magnetic shield and in a magnetic field, $H \sim 1100G$, which was longitudinal with respect to the μ-meson motion, are presented. The electron angular distributions were found to be described by a relation of the form $1 + a \cos\theta$. The values of parameter a were $a = -(0.092 \pm 0.018)$ and $a = -(0.16 \pm 0.04)$ for the emulsion in the magnetic shield and in the magnetic field, respectively. (tr-auth)

9347
π-MESON PRODUCTION BY π^- MESONS IN HYDROGEN NEAR THE THRESHOLD. V. G. Zinov and S. M. Korenchenko (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 34, 301-11(1958) Feb. (In Russian)

Production of π mesons in hydrogen by 307, 333, and 370 Mev π^- mesons was studied with scintillation counters. The differential cross section for production at an angle of 80° in the laboratory system (106° center-of-mass system) of a charged meson in any of the processes $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ or $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ is $(0.10 \pm 0.06) \times 10^{-27}$ $cm^2 \cdot sterad^{-1}$ for $E_{\pi^-} = 307$ Mev, $(0.17 \pm 0.06) \times 10^{-27}$ $cm^2 \cdot sterad^{-1}$ for $E_{\pi^-} = 333$ Mev, and $(0.29 \pm 0.05) \times 10^{-27}$ $cm^2 \cdot sterad^{-1}$ for $E_{\pi^-} = 370$ Mev. (tr-auth)

9348
SCATTERING OF μ-MESONS IN BERYLLIUM. V. G. Kirillov-Ugryumov, and A. M. Moskvichev (Moscow Inst. of Engineering Physics). Zhur. Eksptl'. i Teoret. Fiz. 34, 322-6(1958) Feb. (In Russian)

Scattering of μ mesons with momenta (130 ± 16) Mev $\cdot c^{-1}$ was investigated for beryllium plates. The observed angular distribution agrees within the limits of the statistical results with the distribution expected for a Coulomb interaction between μ mesons and atoms of the substance. (tr-auth)

9349
GENERATION OF π^+ MESONS BY π^- MESONS. Yu. P. Dobretsov and B. A. Nikol'skii (Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 510-11(1958) Feb.

Production of π^+ mesons in nuclear emulsions by π^- mesons with energies of 340 ± 30 Mev was studied. (R.V.J.)

9350
THE ANGULAR DISTRIBUTION OF μ^+ MESONS FROM $(\pi \rightarrow \mu)$ DECAY. N. P. Bogachev, A. K. Mikhul, M. G. Petrashku, and V. M. Sidorov (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 34, 531-2(1958) Feb. (In Russian)

Results are given of studies made with 10,000 cases of $(\pi-\mu)$ decay by π^+ mesons stopped in emulsion bombarded by a synchrotron beam. The angular projection of the μ^+

meson initial motion and the direction of the π meson beam were measured. The coefficient of asymmetry for the angular distribution was 0.048 ± 0.020. Corrections based on the systematic re-evaluation of processes in the emulsion produced a corrected coefficient of assymetry 0.009 ± 0.018, which indicates that the angular distribution of μ^+ meson from $(\pi-\mu)$ decay of stopped π^+ mesons is isotropic. (R.V.J.)

9351

IN CONNECTION WITH THE NOTE OF P. V. VAVILOVA "INTERACTION CROSS SECTION OF MESONS WITH NUCLEONS AT HIGH ENERGIES". N. P. Klepikov (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. Fiz. 34, 533-4(1958) Feb. (In Russian)

An analysis is given to refute the widely existing concept that the results obtained in application of dispersion relations are completely insensitive to the cross section behavior with $\omega \to \infty$. It is shown that even at very high frequencies ω_0 the cross sections σ_∞ derived by consequent use of direct and inverse dispersion relations are determined by the level at which the experimental cross section is extrapolated. (R.V.J.)

Meteorology

Refer to abstract 9167.

Molecular Properties

9352

INFRARED SPECTRUM AND MOLECULAR CONSTANTS OF CT_4. Llewellyn H. Jones and Maxwell Goldblatt (Los Alamos Scientific Lab., N. Mex.). J. Mol. Spectroscopy 2, 103-12(1958) Apr.

The bands, ν_3, ν_4, and $2\nu_3$ of CT_4 have been observed. The ν_{CH} band of CHT_3 was observed also. An analysis of the band ν_3 of CT_4 yields $\nu_3 = 1937.0\ cm^{-1}$ and $\zeta_3 = 0.252$. The data on CT_4 were combined with data in the literature of CH_4 and CD_4 to calculate average valence force constants for the methanes. (auth)

9353

BOND MOMENTS AND BOND MOMENT DERIVATIVES OF $C_2^{12}N_2^{14}$ AND $C^{12}C^{13}N_2^{14}$ FROM INFRARED INTENSITIES. J. W. Schultz and D. F. Eggers, Jr. (Univ. of Washington, Seattle). J. Mol. Spectroscopy 2, 113-19(1958) Apr.

The intensities of ν_3 in $C_2^{12}N_2^{14}$ as well as ν_1' and ν_4' in $C^{12}C^{13}N_2^{14}$ were measured, the latter in an isotopic mixture containing 15.5 atom percent C^{13}. The intensities were interpreted in standard fashion as bond moments and derivatives, after carrying out a normal coordinate calculation. Results of this calculation were 0.8 debye for the CN bond moment, and 0.59 debye/angstrom for the derivative. This value fits both stretching vibrations, indicating that the dipole moments of the two bonds add independently without interaction. (auth)

9354

OPTICAL PROPERTIES AND STRUCTURE OF CERIUM DIOXIDE FILMS. G. Hass, J. B. Ramsey, and R. Thun (U. S. Army Engineer Research and Development Labs., Fort Belvoir, Va.). J. Opt. Soc. Amer. 48, 324-7(1958) Apr.

The refractive index n and the absorption coefficient k of evaporated CeO_2 films were measured in the wavelength region from 0.22 μ to 1.0 μ. Films produced by direct evaporation of CeO_2 were found to be extremely durable and nonabsorbing in the visible and can be used as beam splitters and as high-index films in multilayer film combinations. The refractive index of CeO_2 films depends strongly on the temperature of the substrate. An increase of the substrate temperature from 25°C to 300°C increases the refractive index of the condensed film material at $\lambda = 550$ mμ, from about 2.2 to 2.4. The absorption of CeO_2 films increases strongly below 400 mμ and reaches a maximum at 300 mμ. Evaporated CeO_2 films show the same cubic structure as compact material and crystallize without preferred orientation on amorphous substrates. The crystal size in the condensed films increases with increasing temperature. (auth)

Neutrons

9355 CRT-754

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

POLYNOMIAL APPROXIMATIONS IN NEUTRON TRANSPORT THEORY. PART I. APPLICATION TO THE ONE-GROUP TRANSPORT EQUATION WITH PLANE SYMMETRY. W. R. Conkie. Mar. 1958. 27p. (AECL-576). $1.00(AECL).

It was shown that the error term in the Boltzmann equation, which results when the density per unit solid angle is expanded in Legendre polynomials, is relatively large near the end points of the angular range. This is just the angular region which is important in media where moderate to strong absorption is present, consequently the spherical harmonics method cannot be expected to give good results for such cases without going to rather high order approximations. An attempt is made to alleviate this circumstance by expanding the angular density in Tchebycheff polynomials. This expansion tends to distribute the error uniformly over the angular range and thus represents the angular distribution of neutrons rather more accurately than does the Legendre expansion. The theory will be restricted to the case of the one-group Boltzman equation in plane geometry with isotropic scattering. The conventional form of the spherical harmonics method is discussed together with the method modified by using Tchebycheff polynomials. These methods are discussed from a different view point, the derivation of formulae being made in such a way as to show explicitly the error terms involved in each approximation. It is shown that the calculations can be performed readily for a general polynomial expansion, but that the Legendre and Tchebycheff polynomials occupy a preferred position among these polynomials. The results obtained are applied to the Milne problem with capture, the results for the extrapolated end point within a Tchebycheff approximation being compared to those within the corresponding spherical harmonics approximation. The question of whether the spherical harmonics method or the Tchebycheff method is the more suitable for application to the variety of problems encountered in reactor calculations is discussed. (auth)

9356 NP-6699

A REMARK ON NEUTRON THERMALIZATION THEORY. G. Leibfried. [1957]. 10p.

The slowing down of neutrons by a monoatomic moderator gas with temperature can be expressed by a variational formalism. Using a suitable trial solution one can calculate the effective neutron temperature and the upper limit of the thermal region by variation. Results are given for large moderator masses and small absorption. (auth)

9357

THE PROBLEM OF NEUTRON MODERATION. V. V. Smelov. Atomnaya Energiya 3, No. 10, 317-18(1957).

The angular and energy distribution of neutrons is theoretically derived in a one-atomic gaseous modera-

tor, i.e., for the case that the velocity of the neutrons is comparable with the average thermal velocity of the moderator atoms. (TCO)

Nuclear Physics

9358 NP-6680
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
ABOUT THE $\Lambda^\circ-\alpha$ POTENTIAL FROM THE $^5He_\Lambda$ AND $^9Be_\Lambda$ HYPERFRAGMENT BINDING ENERGIES. Report No. 8/VI. H. Wilhelmsson and P. Zieliński. Jan. 1958. 5p.

With an s state assumed for the Λ° particle, the wave function extends appreciably outside the region of the α-core so only the depth Vo and range a of the potential are important. Taking the binding energy of the Λ° in He^{5*} and Be^{9*}, two relations between Vo and a are found which determine the values of Vo and a. The information obtained about the $\Lambda^\circ-\alpha$ potential may be helpful in the investigation of the Λ°-nucleon potential in order to obtain information about the range and thus about the agent of the Λ°-nucleon force. (W.D.M.)

9359 NP-6686
Weizmann Inst. of Science, Rehovoth, Israel.
ON THE CONNECTION BETWEEN DEGENERACY AND ROTATIONAL STATES IN THE NUCLEAR SHELL MODEL. Harry J. Lipkin. [1958]. 12p.

A method, applicable in systems where a degeneracy exists between states having different angular momenta, is presented for constructing the collective angle coordinate required for the description of rotational states. It is shown that the collective description can also lead to rotational bands having only a finite number of states. (auth)

9360
β NEUTRINO CORRELATION FOR ORIENTED NUCLEI. CASE OF POLARIZED NEUTRONS. [PART I]. Roger Nataf. Compt. rend. 246, 1843-5(1958) Mar. 24. (In French)

The model of beta interaction, proposed in an earlier article (Compt. rend. 244, 1187(1957)), is used to investigate the transitions $\Delta J = 1$ and $\Delta J = 0$. (J.S.R.)

9361
β-NEUTRINO CORRELATION FOR ORIENTED NUCLEI. CASE OF POLARIZED NEUTRONS. [Part II]. Roger Nataf. Compt. rend. 246, 1987-90(1958) Mar. 31. (In French)

An examination is made of the transition $\Delta J = 0$, especially that of the neutron. (tr-auth)

9362
A GLANCE AT NUCLEAR PHYSICS IN HUNGARY. U. Facchini. Energia nucleare (Milan) 5, 225-8(1958) Apr. (In Italian)

A summary is given of works presented at the "Symposium of Nuclear Physics," organized by the Hungarian Society of Physics "Eötvös Loránd" and held from December 3 to 7 at Matrahaza, 100 km east of Budapest. Several foreign groups attended the meeting which was sponsored by Prof. Károly Simonyi, director of the Atomic Physics Department of the Hungarian Central Institute for Nuclear Research. He gave a description of the Atomic Physics Department activity in its five years life. 34 works were presented by Hungarian researchers and 10 by foreign participants. (auth)

9363
DEUTERON CROSS SECTIONS FOR HIGH ENERGY PROJECTILES. John S. Blair (Univ. of Washington, Seattle). Nuclear Phys. 6, 348-58(1958) Apr. (1).

The absorption cross section of a deuteron for high-energy particles is computed in a semi-classical model in which the elementary neutron and proton cross sections are represented by classical black disks and the impulse approximation describes the collision. Computations have been carried out for Hulthén and Gartenhaus wave functions, and results are presented in graphical or tabular form. Approximate formulas and the sensitivity of the calculations to deuteron wave function are discussed. Recent antiproton experiments imply that the shadow corrections are a large fraction of the antiproton-nucleon cross sections. (auth)

9364
PHENOMENOLOGICAL NEUTRON PROTON POTENTIALS. L. C. Biedenharn (Rice Inst., Houston, Texas); J. M. Blatt (Univ. of Sydney); and M. H. Kalos (Nuclear Development Associates, White Plains, N. Y.). Nuclear Phys. 6, 359-403(1958) Apr. (1).

This paper presents in tabular form and discusses some of the features of a number of phenomenological neutron-proton potentials all of which fit the low energy neutron-proton data in the triplet spin state. Special attention has been paid to the influence of different well shapes for the central and tensor forces, and to the effect of an infinite repulsive core. (auth)

9365
ELEMENTARY PARTICLE REACTIONS. C. O. Beasley, Jr. and W. G. Holladay (Vanderbilt Univ., Nashville). Nuovo cimento (10) 7, Suppl. No. 1, 77-90(1958).

On the assumption that the quantum numbers A(attribute) and B(heaviness) are conserved, a procedure has been devised for writing down all the reaction products of the elementary particles. These reaction products are listed together with the production threshold when the projectile is a photon, electron, pion, K particle, anti-K particle, nucleon, or anti-nucleon and the target is a stationary nucleon or a 25-Mev nucleon with momentum toward the projectile. Threshold energies have also been calculated for the Feldman two-stage process. The two-stage process lowers the threshold over the analogous one-stage by roughly 20 to 25%. In the single-stage process the threshold for a 25-Mev target nucleon is some 25% lower than that for a target nucleon at rest. (W.D.M.)

9366
STATISTICAL THEORY OF PARTICLE MULTIPLE PRODUCTION IN HIGH ENERGY NUCLEON COLLISIONS. V. S. Barasenkov, B. M. Barbasev, and E. G. Bubelev (Joint Inst. for Nuclear Research, Doubna). Nuovo cimento (10) 7, Suppl. No. 1, 117-28(1958).

Momentum conservation was neglected in making the calculations, but the statistical weight of a set of particles produced in the particle collision with spins $S_1, S_2, \ldots, S_k$ was assumed to be proportional to the product $\prod_{i=1}^{k} (2S_i + 1)$. Since the spins of strange particles are not exactly known at present, for the estimation of the value of spin the minimum of all possible spins was chosen: $S = 0$ for K mesons and $S = \frac{1}{2}$ for all the other strange particles. Phase volumes in the momentum space in all cases of two and three particle production were calculated. The results of the calculations of respective probability of possible reactions in proton-proton and proton-neutron collisions are given in tabular form. (W.D.M.)

Nuclear Properties

9367 CF-57-6-2
Oak Ridge National Lab., Tenn.
THE EFFECT OF FLUCTUATIONS IN THE WIDTHS ON

NEUTRON REACTION CROSS SECTIONS. L. Dresner. June 1, 1957. 25p. Contract [W-7405-eng-26]. $4.80 (ph OTS); $2.70(mf OTS).

The effect of fluctuations in the widths on the reaction cross sections when the widths are distributed in χ^2-distributions is expressed in terms of a single infinite integral. The integral is evaluated explicitly in terms of tabulated functions in some simple cases, and the results discussed. (auth)

9368 CRT-665

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

RESONANCE CROSS SECTIONS OF FISSIONABLE NUCLEI—ANALYSIS OF U^{235}. E. Vogt. Mar. 1958. 52p. (AECL-574). $1.50(AECL).

The general Wigner-Eisenbud theory is used to develop a method of analysis for the cross sections of fissionable nuclei. The method is employed in giving a reasonable description of the low energy cross sections in U^{235}. The single level fit for U^{235} is known to be unreasonable. Many-level expressions for the cross sections are derived—the only approximation to the general theory being the neglect of all but a small group of resonances. It is shown that regardless of the number or definition of the fission channels the many-level expressions require few level parameters: the E_λ, $\Gamma_{\lambda n}$, $\Gamma_{\lambda\gamma}$ and $\Gamma_{\lambda F}$ of the single level theory for each resonance and a few additional parameters pertinent to the interference between levels. The interference terms are described and shown to be important. The shape and size of the U^{235} cross sections below 2 ev are fitted to within one per cent using (a) only one negative energy resonance of smaller size than in the single level fit; (b) no additional levels to fit the shape other than the observed levels at positive energies; (c) three interference parameters whose size suggests that there are several fission channels in U^{235}. This fit is better and more reasonable than the previous fits of the U^{235} data. (auth)

9369 IDO-16449

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

A MULTILEVEL FORMULA FOR THE FISSION PROCESS. C. W. Reich and M. S. Moore. Mar. 31, 1958. 14p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

The dispersion theory formalism of Wigner and Eisenbud was applied to the problem of interference between resonances in the slow neutron fission cross section. The development presented assumes that the process involves one neutron channel and a large number of channels for the capture process. Although the treatment, for simplicity, assumes that only one fission channel is open, the relevant expressions for the fission cross section are presented in such a form that the generalization to any number of fission channels is readily apparent. Although no restriction as to the number of levels is necessary, the results are of practical use only when the number of assumed fission channels is small. Multilevel expressions for the radiative capture and scattering cross sections are also presented for one fission channel. The radiative capture cross section in the absence of fission is given and shown to differ formally from a sum of single-level Breit-Wigner terms. (auth)

9370

NUCLEAR MULTIPLETS IN LIGHT ODD-ODD NUCLEI AND THEIR MANIFESTATION IN γ-TRANSITIONS FOLLOWING THERMAL NEUTRON CAPTURE. L. V. Groshev and A. M. Demidov. Atomnaya Energiya 3, No. 8, 91-100 (1957).

On the basis of the comparison of the hitherto experimentally found γ transitions in even-odd (odd neutron) and even-even nuclei with $A < 60$, the presence of nuclear multiplets near the ground state is proved. The following nuclei were investigated: Na^{24}, Mg^{25}, Al^{28}, Si^{29}, P^{32}, S^{33}, K^{40}, Ca^{41}, Sc^{46}, Ti^{49}, V^{52}, Cr^{53}, Mn^{56}, Fe^{57}, and Ni^{59}. (TCO)

9371

NEW DATA FOR NEUTRON CROSS SECTIONS. P. K. (K. P.). Atomnaya Energiya 3, No. 8, 169-70(1957).

On the basis of data obtained from the U.S.A., the U.S.S.R., and England, the most probable values for the neutron cross sections and criticality constants for U^{233}, U^{235}, and Pu^{239} are tabulated. (J.S.R.)

9372

THE FORMATION OF Na^{24} AND P^{32} WHEN HIGH-ENERGY PROTONS ENTER INTO INTERACTION WITH COMPLEX NUCLEI. A. K. Lavrukhina, L. P. Moskaleva, L. D. Krasavina, and I. M. Grechishcheva. Atomnaya Energiya 3, No. 10, 285-90(1957).

The cross section for Na^{24} and P^{32} production was determined by means of radiochemical methods. Cu, La, Au, and Th were bombarded with protons of from 120 to 660 Mev. The cross sections are tabulated. (TCO)

9373

MEASUREMENT OF RESONANCE ABSORPTION INTEGRALS IN ZIRCONIUM SPECIMENS. Yu. N. Dobrynin, G. A. Dorofeyev, and I. Ye. Kutikov. Atomnaya Energiya 3, No. 10, 323-4(1957).

Zirconium specimens with a different content of hafnium were introduced into the center of a graphite prism and irradiated with a collimated neutron beam. Measurements were connected with the resonance integral for boron $\Sigma = 375b$. $\int_{0.4\ ev}^{\infty} \sigma(E)\, dE/E$ was measured at (2.3 + 0.5)b for pure zirconium. (TCO)

9374

DETERMINATION OF THE ABSOLUTE INTENSITY OF THE 2.5-Mev γ LINE OF La^{140}. V. A. Arkhipov. Atomnaya Energiya 3, No. 10, 335-6(1957).

Gamma radiation from a La^{140}–Ba^{140} source was used to irradiate deuterium. The resulting neutrons activated rhodium or silver foils. The beta activity of the foils was measured. The 2.6-Mev gamma rays of Th^{228} were used to initiate the same reaction. A comparison of the results led to the determination of the intensity of the 2.5-Mev gamma emission of La^{140} as 0.05 quantum/decay. (J.S.R.)

9375

ELECTRON CAPTURE OF Ba^{133} AND EXCITED STATES OF Cs^{133}. Steven D. Koički, Anka M. Mijatović, and Jovan M. Simić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 1-15(1958) Mar.

The decay $Ba^{133} \rightarrow Cs^{133}$ has been investigated by means of a coincidence scintillation spectrometer. The energy values of the most intense transitions are determined to be 81, 302, and 355 Kev. Five new gamma transitions were found having the energies 53, 78, 160, 274, and 380 Kev. The results of the coincidence measurements are given for these gamma rays. A consistent decay scheme is proposed for $Ba^{133} \rightarrow Cs^{133}$. The spin and parity values for the states in Cs^{133} are discussed, together with possible consequences for the Coulomb excitation of Cs^{133}. It is also found that the mean mode of the decay of Ba^{133} is the K capture to the highest excited level of Cs^{133}, which disagree with the previously reported results. The possible explanation of this capture is discussed. (auth)

9376

TOTAL NEUTRON CROSS SECTION OF MAGNESIUM. V. M. Brajović, P. D. Mirić, and R. V. Popić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 145-9(1958) Mar.

Total cross section measurements of magnesium for neutrons in the energy range 2.17 to 2.83 Mev indicate the existence of two resonant levels in Mg^{25} in this energy region. (auth)

9377

RAPID E2 TRANSITION IN Ra^{224}. Hamlet Vartapetian. Compt. rend. 246, 1846-7(1958) Mar. 24. (In French)

The period of the E2 ray of 84 kev is $T_{½} = (8.4 \pm 0.7) \times 10^{-10}$ sec, having $B(E_2)/e^2 = (0.7 \pm 0.1) \times 10^{-48}$ cm^4. From the hypothesis of strong coupling, the intrinsic quadrupole moment of the Ra^{224} nucleus is $Q_\phi = (6 \pm 0.5) \times 10^{-24}$ cm^2. (tr-auth)

9378

PERIOD OF THE FIRST EXCITED STATE OF MOLYBDENUM-95. Jacques Quidort. Compt. rend. 246, 2119-20 (1958) Apr. 9. (In French)

The period of the first excited state of Mo^{95} was measured by delayed coincidences between two gamma rays emitted after the K capture of 60-day Tc^{95}. The value found was $(7.7 \pm 0.3) \times 10^{-10}$ sec. (tr-auth)

9379

A NEW METHOD OF DYNAMIC POLARIZATION OF ATOMIC NUCLEI IN SOLIDS. Anatole Abragam and Warren George Proctor. Compt. rend. 246, 2253-6(1958) Apr. 14. (In French)

A new principle of dynamic nuclear polarization is discussed. Its experimental verification on a crystal of lithium fluoride is described. (tr-auth)

9380

THE EFFECT OF QUADRUPOLE RELAXATION ON NUCLEAR MAGNETIC RESONANCE MULTIPLETS. J. A. Pople (Univ. of Cambridge, Eng.). Mol. Phys. 1, 168-74 (1958) Apr.

A theory of the broadening of multiplet components in magnetic resonance spectra of coupled nuclei due to electric quadrupole spin-lattice relaxation is presented. It is shown that the broadening of the components of the 1:1:1 triplet for nuclei of spin ½ coupled to a nucleus of spin 1, is ¾ as great for the outer lines as for the central one, provided that the rate of quadrupole relaxation is not too large. This is in agreement with experimental observations on $N^{14}H_3$. A theory of the line shape of the partly collapsed multiplet at higher rates of quadrupole relaxation is also given. (auth)

9381

THE SIZES OF ATOMIC NUCLEI. A. W. Wolfendale. New Scientist 3, No. 73, 26-8(1958) Apr. 10.

The early development of the nuclear model is briefly discussed. Experiments now being conducted at Stanford University to ascertain the sizes of atomic nuclei by electron scattering are described. A comparison is made of the experimental and theoretical values. (J.S.R.)

9382

EFFECTIVE REACTOR CROSS SECTIONS IN MTR FUEL ASSEMBLIES. J. Halperin and J. O. Blomeke (Oak Ridge National Lab., Tenn.) and D. A. Mrkvicka (Argonne National Lab., Chicago). Nuclear Sci. and Eng. 3, 395-402(1958) Apr.

Analyses of uranium, neptunium, and plutonium isotopes have been carried out on dissolved MTR fuel elements. Effective reactor cross sections computed from these measurements are in good agreement with differential cross-section measurements. In particular, effective cross-section values were found for U^{236} and U^{238} of 34 barns and 23 barns, respectively. (auth)

9383

SLOW NEUTRON VELOCITY SPECTROMETER STUDIES OF THE TOTAL AND FISSION CROSS SECTIONS OF U^{235}. E. Melkonian, V. Perez-Mendez, Miriam Levin Melkonian, W. W. Havens, Jr., and L. J. Rainwater (Columbia Univ., New York). Nuclear Sci. and Eng. 3, 435-44(1958) Apr.

Results of cross-section measurements on U^{235} are presented. Parameters of some of the lowest energy levels are given. The observed average cross sections in the energy region above 100 ev yield $\sigma_{n,\gamma}/\sigma_f \equiv \alpha = 0.64$ and $\Gamma_n^0/D = 1.09 \times 10^{-4}$ in agreement with other observations. (auth)

9384

RADIOACTIVITY OF ^{178}Ta, ^{179}Ta AND ^{180}Ta. J. H. Carver and W. Turchinetz (Australian National Univ., Canberra). Proc. Phys. Soc. (London) 71, 618-26(1958) Apr.

The neutron deficient isotopes Ta^{178}, Ta^{179}, and Ta^{180} have been produced by photodisintegration of Ta^{181} and studied with scintillation spectrometers used singly and in coincidence. The identification of each isotope is based on a knowledge of the (γ,n) threshold and an appropriate choice of bremsstrahlung energies. Radioactive Ta^{178} is shown to comprise an isometric doublet with half lives 9.5 ± 0.1 min and 150 ± 10 min. The 9.5 min activity populates levels in Hf^{178} at 0, 91, and possibly 1480 kev, the first two by both electron capture and β^+ emission and the last by electron capture, while the 150 min activity decays by electron capture to a level of Hf^{178} at 1046 kev. A decay scheme is proposed based on the experimental results and the strong coupling collective model of Bohr and Mottelson. Evidence is presented to support the recent contention that Ta^{179} decays by electron capture to the ground state of Hf^{179}. The observed γ radiation from 8.15 hour Ta^{180} is in general agreement with the decay scheme of Brown et al. except that there is no evidence for gamma radiation in the energy range 175 to 450 kev. (auth)

9385

ON THE BINDING ENERGY OF THE ^{16}O NUCLEUS. J. Dabrowski (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) 71, 658-67(1958) Apr.

A variational calculation of the binding energy of the O^{16} nucleus is presented. A two-body central Yukawa interaction with a hard core of radius a, and with Serber exchange is assumed and the parameters adjusted to fit the low energy data. A two-parameter trial function in the form of a product of harmonic oscillator shell model wave functions and correlation functions is assumed, and the Ursell–Jastrow cluster development is applied. The results show that the assumed two-body interaction with $0.2 < a < 0.6$ is capable of reproducing the saturation of both binding and density of the O^{16} nucleus. (auth)

9386

ENERGETIC γ TRANSITION OF LOW INTENSITY IN THE DECAY Bi^{214}(RaC) $\xrightarrow{\beta}$ Po^{214}(RaC'). Ulrich Hauser (Universität, Heidelberg). Z. Physik 150, 593-8(1958). (In German)

With a deuterium-filled proportional counter as a gamma spectrometer, the energy-rich gamma decay of Po^{214} (RaC') was investigated. Five intensity-poor gamma lines were detected. Three of these lines correspond directly to the gamma decay to the ground state of levels which originate in the alpha decay of Po^{214}. (tr-auth)

9387

ON THE γ AND α DECAY OF THE EXCITED STATE OF Po^{214}(RaC'). Ulrich Hauser (Universität, Heidelberg). Z. Physik 150, 599-613(1958). (In German)

By means of the alpha-decay theory and the theory of multipolar transitions the absolute or standardized transition probabilities for gamma emission of several excited states of Po^{214} were calculated, and the spin and parity were determined. From this a decay scheme was proposed, and a

complete classification of the 13 alpha groups found by Rutherford in the decay scheme $Po^{214} \rightarrow Pb^{210}$ was given. The calculated standardized gamma transition probabilities agree surprisingly well with each other and with the predicted values. The alpha emitting levels divide themselves into equi-distant groups, which obey a rule of the form $E = E_\phi + n\underline{D}$. This can be interpreted as a consequence of a collective motion of the nucleus. (tr-auth)

9388

THE KIND OF GAMOW-TELLER INTERACTION IN THE DECAY OF Li^8. K. H. Lauterjung and B. Schimmer (Max-Planck-Institut, Heidelberg), and H. Maier-Leibnitz (Technischen Hochschule, Munich). Z. Physik 150, 657-9 (1958). (In German)

The aim of this work was to decide, from the electron–antineutrino angular correlation in the decay of Li^8, whether tensorial or axial coupling exists in the Gamow-Teller decay. The experimental results show a preponderance of the axial coupling. (tr-auth)

9389

NUCLEAR RESONANCE FLUORESCENCE FROM GAMMA RADIATION OF Ir^{191}. Rudolf L. Mössbauer (Max-Planck-Institut für medizinische Forschung, Heidelberg). Z. Physik 151, 124-43(1958). (In German)

Nuclear resonance absorption of the 129-kev gamma radiation in Ir^{191} following the decay of Os^{191} was investigated. The effective cross section for the resonance absorption was measured as a function of the temperature of the source and absorber in the temperature range $90°K < T < 370°K$. The life of the 129-kev level in Ir^{191} is $3.6^{+1.3}_{-0.8} \times 10^{-10}$ sec. The absorption cross section shows at low temperatures a sharp increase as a result of the crystal linkage of the absorber and the source materials. The theory of Lamb on the resonance absorption of slow neutrons in crystals was applied to the nuclear resonance absorption of gamma radiation. At low temperatures a strong dependence of the effective cross section of the nuclear absorption on the frequency distribution in the vibration spectrum was observed. (tr-auth)

9390

THE INNER CONVERSION FACTOR IN THE 40 kev TRANSITION OF Tl^{208}. Ingrid Yvonne Krause (Physikalischen Institut der Universität, Göttingen, Germany). Z. Physik 151, 210-19(1958). (In German)

The intensity of the 40-kev gamma radiation, with respect to the number of alpha particles in Bi^{212} decay, was measured with a scintillation spectrometer. With the decrease of the disturbing gamma background, a thinner NaI crystal was used for the detection of the quanta. With $35.4 \pm 0.7\%$ for the branching ratio and $71.5 \pm 1.5\%$ excitation of the levels, $\alpha = 22.8 \pm 1.0$ for the internal conversion factor. From the ratio $\alpha_L/\alpha = 0.80 \pm 0.02$ one obtains $\alpha_L = 18.2 \pm 1.0$. This value is lower than that calculated for an M1 transition and a point nucleus. The agreement between the value calculated for a nucleus with radius $R = 1.2 \times 10^{-13} \times A^{1/3}$ cm and experiment is good. (tr-auth)

Nuclear Reactors

9391 AECU-3390

Michigan. Univ., Ann Arbor. Engineering Research Inst.
CONSIDERATIONS OF THE USE OF A MULTIPLE-PURPOSE REACTOR IN A RUBBER-TIRE PLANT. L. E. Brownell, S. N. Purohit, M. Weech, R. E. Balzhiser, and A. H. Lebo. Aug. 1956. 61p. Contract AT(11-1)-162. (ERI-1943-7-77-P). $10.80(ph OTS); $3.90(mf OTS).

A feasibility study of the use of a multipurpose reactor in a rubber-tire plant was made. A liquid-metal-fuel reactor of 75-Mw power output was selected to produce the steam and electric power for the plant. Also it is proposed that the gamma radiation from the fission gases produced by the nuclear reactor be used in the vulcanization of tires. In the proposed design 46.5% of the total tire production is to be vulcanized by a combination of steam heat and a 10-Mr dose of gamma radiation; the remaining 53.5% of the production will be vulcanized by steam alone. It is estimated that the total capacity of the nuclear plant will be 17,000 tires/day, compared to about 12,500 tires/day for a tire plant using thermal vulcanization alone and having the same power output. Shield thickness for the radiation facility is estimated to be equal to 7 ft, 6 in. of concrete around the radiation chamber in order to reduce the radiation level outside the chamber to 1.5 mr/hr. (auth)

9392 AECU-3589(Rev.)

Division of Reactor Development. Engineering Development Branch, AEC.
REACTOR SAFETY BIBLIOGRAPHY. Selected Unclassified References. May 1957. 24p. $4.80(ph OTS); $2.70 (mf OTS).

This is a revision of the Reactor Safety Bibliography prepared for the Reactor Safety Conference held at New York City on Oct. 31, 1957. It is not an exhaustive review of the published material on reactor safety but includes 223 selections from reports and published literature as a guide to some of the more recent and relevant material. (J.E.D.)

9393 APAE-8

Alco Products, Inc., Schenectady, N. Y.
ARMY PACKAGE POWER REACTOR ZERO POWER EXPERIMENTS (ZPE-1). J. W. Noaks and W. R. Johnson. Feb. 8, 1957. Decl. Aug. 14, 1957. 134p. Contract AT(11-1)-318. $2.75(OTS).

The complete results of the Army Package Power Reactor Zero Power Experiments performed on the APPR-1 core at the Alco Criticality Facility are given. The fully loaded cold clean core, containing 22,480.1 grams of U^{235}, has an excess K of approximately 16%. The temperature coefficient at 170°F is approximately -0.67×10^{-4} $\Delta K/°F$. The presence of fine structure in neutron flux measurements and control rod calibrations is evident and further study of these effects from an academic point of view seems justified. Peak to average flux in the core is as much as 4 to 1 in the tip of the center control rod fuel element. However, flux suppressors placed in the water hole in this region are effective in reducing this value to approximately 3 to 1. (auth)

9394 APAE-27

Alco Products, Inc., Schenectady, N. Y.
ANALYSIS OF EXTENDED ZERO POWER EXPERIMENTS ON THE ARMY PACKAGE POWER REACTOR ZPE-2. B. J. Byrne, ed. May 7, 1958. 201p. Contract AT(30-3)-278. $31.80(ph OTS); $9.30(mf OTS).

The bulk of the analysis is based on the modified two-group model and limited to separate, axial and radial, one-dimensional calculations. Cross sections, group constants, and information concerning the material content and geometry of the APPR-1 are included in the appendices. (M.H.R.)

9395 APAE-31

Alco Products, Inc., Schenectady, N. Y.
REVIEW OF THE CORROSION PRODUCT RADIOACTIVITY PROGRAM AT THE ARMY PACKAGE POWER REACTOR. A. L. Medin. Apr. 25, 1958. 19p. $3.30(ph OTS); $2.40 (mf OTS).

An analysis and a summary are given of the radioactivity buildup program at the Army Package Power

Reactor. Due to the wide fluctuation of water and crud results, only general interpretations can be made with this data. Metal test coupon data indicate a substantially greater buildup on Croloy 16-1 metal than on Type 304 stainless steel. Coupled with the decreased ability to remove the radioactivity buildup on Croloy 16-1 by conventional descaling techniques, the implication is that this metal might pose a serious problem for use as steam generator material. It was emphasized, however, that results to date are only preliminary and extensive additional experimentation would be required to reach more definite conclusions. (auth)

9396 CEA-323
France. Commissariat à l'Énergie Atomique, Paris.
TECHNIQUE DES CONTROLES DES REACTEURS NUCLEAIRES (these). (Techniques of Controls of Nuclear Reactors (thesis).) Jacky Weill. Dec. 2, 1953. 95p.
Submitted to the Univ. of Paris.

The problem of reactor control techniques was studied with the aim of effecting control of the Saclay heavy water reactor, but as the problem was approached in its entirety, the techniques can be used for all reactors using natural uranium. Although nuclear measurements are chiefly discussed, non-nuclear measurements are also included, such as thermodynamic measurements, water level measurements, and manipulation of control rods by servomechanisms. Instruments for the detection and measurement of thermal neutrons and the measurement of ionization currents are discussed, and their construction is described. Two original methods for measurement of the reactivity are presented. Wiring diagrams are given for all the control instruments discussed. (J.S.R.)

9397 CF-55-8-190(Rev.)
Oak Ridge School of Reactor Technology, Tenn.
A FOOD STERILIZATION REACTOR. Reactor Design and Feasibility Problem. E. O. Guernsey, R. M. Ball, T. V. Kavanagh, C. T. McDaniel, G. T. Schnurer, and C. E. Whittle. Aug. 1955. 153p. $3.00(OTS).

A study was made to determine the feasibility of sterilizing beef with reactor-produced gamma radiation. Results of the study were measured against specifications established by the U. S. Army Quartermaster Corps and against estimated results for meat sterilization with other sources of radiation. A conceptual design for a reactor-irradiation system, involving activation of a medium in the blanket of a heterogeneous reactor, satisfies these specifications. It compares favorably with other sources of radiation. (auth)

9398 CF-57-2-130
Oak Ridge National Lab., Tenn.
THE PHYSICS OF THE FUSED-SALT REACTOR EXPERIMENT. William Krasny Ergen. Feb. 22, 1957. Decl. July 5, 1957. 19p. Contract [W-7405-eng-26]. $0.50 (OTS).

In 1954 the Oak Ridge National Laboratory operated, for demonstration purposes, a high-temperature circulating-fuel reactor, employing as fuel enriched uranium fluoride dissolved in molten fluorides of other cations. A BeO moderator was used. At a maximum power of 2.5 Mw, 100 Mw hr were obtained. A negative temperature coefficient resulting largely from fuel expansion yielded exceptional stability of the reactor, and made the reactor a slave of the power demand. Xe^{135} and some of the other fission fragments are not retained in the fuel; hence, there is no xenon poisoning and relatively little danger of spreading of gaseous fission fragments in case of an accident. The advantages of liquid-fuel reactors (elimination of radiation damage and thermal stresses in solid fuel elements, ease of fabrication and fuel reprocessing) are combined with low pressures at very high temperatures. (auth)

9399 CF-58-4-43
Oak Ridge National Lab., Tenn.
HRE-3 BLANKET HEAT EXCHANGER AS A FEEDWATER REACTOR RATHER THAN AS A STEAM GENERATOR. R. C. Robertson. Apr. 14, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

There may be an advantage to designing the HRE-3 vertical shell and tube slurry heat exchanger as a feedwater heater rather than as a steam generator from the standpoint of space requirement and blowdown problems. This study of the effect of this arrangement on the thermal efficiency of the heat-power cycle indicates that the gross electrical generating capacity of HRE-3 would be reduced by about 500-kw, or about 3 to 4% of the output. It is concluded that, (a) there is sufficient merit in using the exchanger as a feedwater heater to warrant continued study of the concept, and (b) the effect on the thermal efficiency is so small as to not be a major deciding influence. (auth)

9400 CF-58-4-44
Oak Ridge National Lab., Tenn.
PRESSURIZATION OF HRE-3 WITH AN OXYGEN-INERT GAS MIXTURE. N. Hilvety. Apr. 15, 1958. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Calculations made on the possibility of pressurizing HRE-3 with oxygen-helium and oxygen-argon mixtures indicate that such a system is feasible, but not necessarily more desirable than use of oxygen alone. The explosion hazard would not be reduced significantly by use of the inert gas and the off-gas design problems would be somewhat more difficult. (auth)

9401 CF-58-4-101
Oak Ridge National Lab., Tenn.
DIRECT MAINTENANCE PRACTICES FOR THE HOMOGENEOUS REACTOR TEST. S. E. Beall and R. W. Jurgensen. Apr. 18, 1958. 42p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

The Homogeneous Reactor Test is designed for maintenance to be performed while the parts of the reactor are partially or completely submerged in water to reduce radiation levels. Tools with long handles permit the operator, standing above the equipment, to disconnect flanged joints, air lines, electrical and instrument leads, etc., in a minimum time. The techniques and tools employed to accomplish these various operations and to minimize intermixing of the contaminated process fluids with the shielding water are described. Estimates of shutdown times and costs of tools and spare parts are presented also. (auth)

9402 CF-58-4-119
Oak Ridge National Lab., Tenn.
RATES OF CORROSION PRODUCT REMOVAL FROM CIRCULATING SYSTEM BY FILM FORMATION AND SETTLING. J. C. Suddath. Apr. 24, 1958. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Iron oxide deposits removed from high pressure system of HRT after the first power run will be analyzed for Fe^{59} in an attempt to determine the time these deposits were circulated prior to deposition (settling or film formation). Deposits available are film from corrosion specimens (stainless steel, zirconium and titanium) and settled particles. (auth)

9403 HW-51855
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
FABRICATION OF ALUMINUM-PLUTONIUM FUEL ELE-

MENTS FOR LATTICE TESTS IN SUPPORT OF PRTR. W. J. Bailey, R. K. Koler, and D. A. Patterson. Jan. 3, 1958. 32p. Contract W-31-109-Eng-52. $1.00(OTS).

The preparation and cladding of the cores for the Al–Pu alloy fuel elements are described. It was demonstrated that Al–Pu alloy fuel elements can be fabricated by the described procedure; however, the production rate would not be adequate for fueling a reactor. (M.H.R.)

9404 IDO-16440

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SPHERICAL HARMONIC METHODS IN SLAB GEOMETRY. D. R. Metcalf and G. A. Cazier. Mar. 21, 1958. 38p. Contract AT(10-1)-205. $1.25(OTS).

The P-1 and P-3 spherical harmonic approximations to the Boltzmann transport equation in slab geometry and an IBM 650 machine program are developed to obtain flux plots from cross section and dimension input data. An application was made to a SPERT-III fuel assembly with stainless steel clad plates. In the P-3 approximation at 68°F the ratio of the average flux in the moderator to the average flux in the fuel plate is 1.05. The conclusion is that for SPERT-III fuel assemblies with the spacing that is at present contemplated it is a fairly good approximation to consider all materials homogeneously distributed in the fuel regions. (auth)

9405 IDO-16443

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

AN ESTIMATE OF THE HEAT GENERATION AND DISTRIBUTION IN THE MTR. R. A. Grimesey. Mar. 28, 1958. 19p. Contract AT(10-1)-205. $0.75(OTS).

A breakdown of U^{235} fission energy and its distribution in the Materials Testing Reactor is given based on reasonably simplifying assumptions. All important secondary sources of γ radiation due to neutron absorption are also considered based on macroscopic cross sections for the 3×9 loading in the MTR. All calculations are based on the reactor operating at 40 Mw. The breakdown of heat generation and of heat distribution is tabulated. No attempt is made here to estimate the heating in regions beyond the reactor tank vessel, except to indicate the energy escaping to the graphite region. (auth)

9406 KAPL-1909

Knolls Atomic Power Lab., Schenectady, N. Y.

IRRADIATION BEHAVIOR OF DISPERSION FUELS. D. W. White, A. P. Beard, and A. H. Willis. Oct. 1, 1957. 54p. Contract W-31-109-Eng-52. ([KAPL-P-1849]). $1.50 (OTS).

The dispersion fuel concept offers a method for minimizing irradiation-induced property changes in nuclear fuel systems by localizing fission damage into regulated domains within the system. The system is thereby provided with a structural framework, or matrix, whose properties are relatively unaffected by the dynamic and impurity effects of fission fragments. Dispersion-type fuel systems whose irradiation behavior has been, or is being, investigated in the United States are listed. The extent of property retention in a dispersion fuel alloy is dependent on the materials selected for the fuel-bearing and matrix phases and on their microstructural arrangement in the alloy. The consequences of varying the materials and fuel-phase particle size and volume fraction are discussed. From experimental observations it is shown that, by proper control of these parameters within the bounds of existing technology, the dispersion concept does provide improvement in property retention over alternate alloy design concepts. (auth)

9407 KAPL-M-WS-2

Knolls Atomic Power Lab., Schenectady, N. Y.

COMPARISON OF THE WIGNER WILKINS THERMAL SPECTRA WITH THE MEASURED SPECTRA IN HOT AND COLD WATER AND HOT AND COLD FUEL–METAL–WATER MATRICES. W. Skolnik. Apr. 15, 1958. 14p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Recently, Slovacek and Stone measured the thermal neutron spectra emanating from cold and hot (585.8°K) water and from a fuel-zirconium-water matrix of 1:1 metal-water ratio, a fuel loading of 0.0925 g/cc with cold and hot (585.8°K) water as moderator. Using a digital machine coding of the Wigner-Wilkins equation, thermal spectra for these regions were calculated. Good agreement was found for the fuel matrix cases and it was concluded that the Wigner-Wilkins theory applies. Poor agreement was found for the water cases, but it was felt this was due to the smallness of the test region. (auth)

9408 LWS-24626

California Research and Development Co., Livermore, Calif.

STATUS REPORT ON FEASIBILITY STUDY OF A SLURRY-TYPE LATTICE (A-12). H. L. Hollister. July 1, 1952. Decl. Sept. 27, 1957. 18p. (CRD-T4B-181). $3.30(ph OTS); $2.40(mf OTS).

Homogeneous reactors are considered from the standpoints of breeding and economy. From these considerations, heterogeneous reactors appear more advantageous. (D.E.B.)

9409 NAA-SR-1850

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ORGANIC MODERATED REACTOR EXPERIMENT QUARTERLY PROGRESS REPORT [FOR] NOVEMBER–DECEMBER 1956. C. A. Trilling, ed. May 1, 1958. 48p. Contract AT(04-3)-88. $1.50(OTS).

The effects of the revised critical assembly procedure and the redesign of the control rod assemblies on the original facilities are discussed. The stability of parallel flow with temperature-dependent surface fouling was studied. Burnout heat fluxes for diphenyl and water were compared. A chart showing the effects of airborne diphenyl at various concentrations is shown. The results obtained for the irradiation of isopropyl diphenyl, diphenyl, and Santowax R are described. Experimental heat transfer runs with unirradiated diphenyl in the laboratory heat transfer loops were completed and data are given. Information on the physical properties of organic coolants is plotted. Corrosion test results for organic coolants' effects on metals are tabulated. (For preceding period see NAA-SR-1800.) (M.H.R.)

9410 NAA-SR-2400(Pt. II)

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ANNUAL TECHNICAL REPORT, AEC UNCLASSIFIED PROGRAMS, JANUARY–DECEMBER 1957. PART II. Mar. 15, 1958. 120p. Contracts AT-11-1-GEN-8; AT(04-3)-49; and AT(04-3)-88. $4.40(OTS).

Lattice-buckling and intracell-flux-distribution measurements were completed for 8 different hydrocarbon-moderated lattices. A study of neutron slowing down in diphenyl and other hydrogenous materials was also made. The thermal neutron flux near the interface of uranium slabs and graphite was measured. Initial comparisons with a transport-theory calculation were made. A preliminary theoretical treatment of moderation by chemically bound hydrogen was achieved. Significant improvements were

made in the methods of calculating resonance integrals. Hall coefficient and resistivity measurements were carried out on high-purity polycrystalline U, Th, and U–Mo alloys between 1.2°K and room temperature. Graphite expansions after exposures to Na between 950 and 1200°F for times up to 2000 hours are listed. The phase-equilibrium study of the Bi–$BiCl_3$ system was completed. Solubility studies of Cd in $CdCl_2$, $CdBr_2$, and CdI_2 were carried out from the freezing point of the salts up to 1000°C by the decantation method. Solubility studies were carried out with the mercury–mercuric chloride system using thermal analysis and the visual technique. The cryoscopic numbers of Bi dissolved in $BiCl_3$ and Cd dissolved in CdI_2 were found. Vapor pressure measurements on ThF_4 and Th were made. Results are given for fission products removed from irradiated Th–10 wt. % U by oxide drossing and molten salt electrofining. Work on the fuel reprocessing experiment and reactor safety devices is summarized. (M.H.R.)

9411 NAA-SR-Memo-1586

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PRELIMINARY ESTIMATE OF PRESSURES EXPECTED IN A CLOSED MODERATOR CAN. R. L. McKisson. Mar. 5, 1956. 18p. $3.30(ph OTS); $2.40(mf OTS).

Each moderator can of the SRE is equipped with a "schnorkel" tube which extends from the can into the helium-filled space above the hot sodium. The tube acts as a pressure equalizer and assures that the internal pressure of the moderator can always equal that of the helium space. The possibility of eliminating the "schnorkel" in future designs was examined. (W.L.H.)

9412 NDA-2057.4-2

Nuclear Development Corp. of America, White Plains, N. Y.

AN ELECTROLYTIC ANALOG FOR REACTOR HEAT TRANSFER PROBLEMS. P. Anthony and G. Friedensohn. Mar. 1, 1957. 43p. For Pratt and Whitney Aircraft Div. $7.80(ph OTS); $3.30(mf OTS).

An electrolytic analog capable of solving two-dimensional steady-state heat transfer problems involving distributed heat sources and a variety of boundary conditions has been designed, constructed, and tested. The design was based on the results of an analytical and experimental program described in report NDA 57-30. A sample problem, whose solution was known, was run on the analog. A comparison of the analog solution with the known solution indicated a standard deviation of less than one percent. (auth)

9413 NDA-2063-6

Nuclear Development Corp. of America, White Plains, N. Y.

FABRICATION AND QUALITY CONTROL METHODS FOR ARMY PACKAGE POWER REACTOR FUEL ELEMENTS. A. E. Surosky. Feb. 28, 1958. 56p. Contract AT(30-3)-212. $9.30(ph OTS); $3.60(mf OTS).

Production procedures are formulated which specify appropriate quality control techniques to assure the adequacy of the elements so produced. A step-by-step description of the fabrication process formulated is presented. The problems involved and the solutions obtained are described in some detail. This process was confirmed up to the final braze-assembly operation. Sufficient investigation of assembly procedures was accomplished to permit the definition of the best currently available assembly technique. Recommendations are made for development work required to improve the specified processes. (auth)

9414 NP-6695

Kernreaktor Bau- und Betreibs-Gesellschaft m. b. H., Karlsruhe, Germany.

PHYSIKALISCHE GESICHTSPUNKTE BEIM ENTWURF EINES FORSCHUNGS-REAKTORS MIT LEICHT ANGEREICHERTEM URAN (1,5% U^{235}) ALS BRENNSTOFF UND SCHWEREM WASSER ALS MODERATOR UND KÜHLMITTEL. Bericht Nr. 11. (Physical Aspects in the Design of a Research Reactor with Slightly Enriched Uranium (1.5% U^{235}) as Fuel Element and Heavy Water as Moderator and Coolant. Report No. 11). H. Werner and H. Rief. Sept. 6, 1957. 132p.

Continuation of Report No. 9 (NP-6445).

The physical parameters are tabulated. (J.S.R.)

9415 NRL-5077

Naval Research Lab., Washington, D. C.

NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART IV. CONTROL SYSTEM. M. P. Young and G. F. Wall. Nov. 25, 1957. 96p.

The design of the NRL Research Reactor control system was guided by the desire for extreme safety and versatility of operation. The electronic instrumentation for control includes a startup channel, a logarithmic signal channel, a linear signal channel, a gamma channel, and two safety channels. Duplicate equipment is used extensively throughout the control system. This permits load sharing when all electronic units are operative; or, when a single unit fails, the operative unit can take over the load until the other one is repaired or replaced, without shutting down the reactor. There are numerous backup devices for automatic shutdown in case of reactor runaway, extensive monitoring and warning systems to anticipate and correct unsafe conditions automatically, or to allow the operator to prevent unsafe conditions, and numerous interlocks to prevent unsafe sequences of operation which might arise from inadvertent action of the operator or failure of critical instruments. For flexibility of operation as a research tool, a choice of control instruments and interlocks is available for different modes of operation. All the electronic equipment in the control system was fabricated in NRL shops. (auth)

9416 ORNL-2505(Rev.)

Oak Ridge National Lab., Tenn.

THE ORNL GAS-COOLED REACTOR. MATERIALS AND HAZARDS. May 22, 1958. 163p. Contract W-7405-eng-26. $3.00(OTS).

This report may be considered as Part 5 of ORNL-2500.

The experimental program proposed for advancing the technology of bulk oxide fuel, coolant, and the various structural materials to a stage sufficient for use in such a reactor is outlined and explained. Component tests of heat transfer systems will be operated to give a better understanding of the aerodynamics and heat transfer characteristics of the reactor system. The proper gas-handling techniques for the reactor system will be developed as an outgrowth of both in- and out-of-pile experiments with large-scale loops. The single largest developmental undertaking is the correlation of the manufacturing method for the UO_2 with its radiation damage characteristics. Statistical radiation damage testing will be conducted, with the variables being manufacturing methods of the oxide, density of the body, temperature, burn-up and stress on the element. Hazards covered include: gas stream contamination, the release of fission gases in the fuel capsule, shutdown activity and dose calculations, the removal of afterheat, nuclear excursion, the containment of radioactivity, the release of radioactivity, and the potential energy of the graphite. (M.H.R.)

9417 TID-7546

France. Commissariat à l'Énergie Atomique, Paris and Atomic Energy Commission, Washington, D. C.
FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. (Issued in two books: (Bk. 1, Sessions I, II, and III), 371p. and (Bk. 2, Sessions IV, V, VI, and VII), 448p.) $7.00(OTS).

Papers are presented in the following major categories: applied metallurgical research, natural-uranium metallic fuel elements, enriched-uranium metallic fuel elements, nonmetallic fuel elements, corrosion of U alloys, irradiation effects on U, its alloys, and its compounds, and Pu fuel elements. (M.H.R.)

9418 TID-7546(p.3-8)

Division of Reactor Development, AEC.
SURVEY OF BASIC ENGINEERING METALLURGY RESEARCH PROGRAMS OF THE DIVISION OF REACTOR DEVELOPMENT. J. M. Simmons. p.3-8 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 6p.

The Metallurgy Research Program, sponsored by the Engineering Development Branch of the Division of Reactor Development, has one prime objective: to obtain data and information for advancing the understanding and application of the basic laws of metallurgy in the nuclear field. Five major areas of investigation are covered by this program: 1. fuel elements (a) plutonium fuels, (b) advanced types of fuel, (c) fuel for high-temperature operation, (d) radiation damages to fuel elements, and (e) basic engineering studies on fissionable and fertile materials; 2. metals, alloys, and materials; 3. components and equipment; 4. control rods; and 5. production techniques. Each area is discussed in general, with indications as to the trend and probable achievement in the area. (auth)

9419 TID-7546(p.9-17)

France. Commissariat à l'Énergie Atomique, Paris.
ELECTRONIC WELDING OF METALS. J. A. Stohr. p.9-17 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 9p.

The limitations of the electronic welding method are discussed. An electron welding apparatus is described and some others are illustrated. Possible types of welding are shown in drawings. (M.H.R.)

9420 TID-7546(p.18-26)

France. Commissariat à l'Énergie Atomique, Paris.
THERMOPNEUMATIC CLADDING. M. Gauthron. p.18-26 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 9p.

Thermopneumatic cladding is based on the same principle as hydraulic cladding, but uses a hot gas as the compressing fluid. Some installations are illustrated and applications mentioned. (M.H.R.)

9421 TID-7546(p.29-45)

National Lead Co. of Ohio, Cincinnati.
CASTING AND FABRICATION OF NATURAL URANIUM. F. L. Cuthbert. p.29-45 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 17p.

A general review is presented of the important and more critical aspects of technology involved in the casting and fabrication of natural uranium. The preparation of uranium metal suitable for melting stock to produce ingots or other uranium-metal shapes is discussed. Recent development work involved in vacuum-induction casting, centrifugal casting, and melting under a protective salt cover is described. Techniques involved in the preparation of uranium alloys by melting and involving not more than 2% of the alloying ingredient are presented. The fabrication of natural uranium fuel elements by rolling, swaging, and machining is described, along with the heat-treatment involved in these operations. The preparation of uranium-metal shapes utilizing powder-metallurgy techniques is also described. (auth)

9422 TID-7546(p.46-74)

Mallinckrodt Chemical Works, St. Louis.
BOMB REDUCTION, FORGING, AND EXTRUSION OF URANIUM AND URANIUM ALLOYS. J. A. Fellows. p.46-74 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 29p.

A process for the production of pure uranium in 1.5-ton masses by a bomb reaction of UF_4 with magnesium is described. Similar techniques are discussed for the production of binary uranium alloys by thermite reaction, and the limitations of the process are indicated. Fabrication methods for the hot forming of bomb reguli by forging in the alpha range and by extrusion in both gamma and alpha phases are described. Examples of structure are presented, and the influence of alloy additions on both forming characteristics and product quality are illustrated. (auth)

9423 TID-7546(p.75-101)

Du Pont de Nemours (E. I.) & Co., Wilmington, Del.
GRAIN REFINEMENT OF URANIUM BY HEAT-TREATMENT AND ALLOYING. E. E. Hayes. p.75-101 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 27p.

Two basic methods of refining the grain structure of cast and fabricated uranium are described, and a review of applicable data is presented. Practical refinement of grain structures in unalloyed uranium is based on rapid cooling through the beta-alpha phase transformation. Additional refinement of rapidly cooled uranium may be obtained by a recrystallization process during a short-time anneal in the high alpha phase. Alloys of uranium containing up to several atomic per cent of additive that can be used for grain-size control are described. Chromium, silicon, and zirconium are among the most effective grain-refining elements. The neutron absorption cross section and the concentration required for each of these elements are sufficiently low to permit the use of natural uranium in thermal-neutron reactors. (auth)

9424 TID-7546(p.102-19)

Oak Ridge National Lab., Tenn.
TECHNIQUES FOR CANNING AND BONDING METALLIC URANIUM WITH ALUMINUM. J. E. Cunningham and R. E. Adams. p.102-19 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 18p.

The technology of canning and bonding metallic uranium with aluminum for reactor service is discussed. The historical background leading up to the development of the now classical fuel element, a cylindrical uranium slug canned in aluminum, is traced. The technological factors associated with the design and manufacture of these reactor components are reviewed. The use of an aluminum–silicon alloy layer to retard interaction between aluminum and uranium and to promote the transfer of heat across the interface is demonstrated. A metallurgical bond can be achieved by dipping aluminum and uranium in molten aluminum–silicon eutectic alloy; a thin adherent layer of the compound $U(Al,Si)_3$ is thus formed at the AlSi/U interface which acts as an effective diffusion barrier up to a temperature of about 350°C. The importance of the closure problem is discussed. A detailed description of the process developed and adopted for manufacturing AlSi-bonded slugs for fueling the ORNL Graphite Reactor is given. Techniques for canning the fuel element for the Brookhaven National Laboratory reactor, as well as methods of testing, are briefly reviewed. (auth)

9425 TID-7546(p.120-41)
Atomic Energy of Canada Ltd. [Chalk River Project], Chalk River, Ont.
ALUMINUM SHEATHING OF FLAT URANIUM PLATES BY EXTRUSION CLADDING. A. J. Mooradian. p.120-41 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 22p.
Also issued separately as CRL-46 (AECL-513).

9426 TID-7546(p.142-56)
France. Commissariat à l'Energie Atomique, Paris.
COEXTRUSION APPLIED TO THE FABRICATION OF SOLID OR DISPERSE FUEL ELEMENTS. R. Montagne and L. Meny. p.142-56 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 15p.
Results are given from experiments with Zr-clad U fuel elements produced by coextrusion which indicate that this cladding process appears to be of interest. Experiments also demonstrated that U–Al alloy tubes (30 wt. % U) clad internally and externally with Al can be fabricated by coextrusion. (M.H.R.)

9427 TID-7546(p.157-81)
Nuclear Metals, Inc., Cambridge, Mass.
ZIRCONIUM CLADDING OF URANIUM AND URANIUM ALLOYS BY COEXTRUSION. A. R. Kaufmann, J. L. Klein, P. Loewenstein, and H. F. Sawyer. p.157-81 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 25p. (NMI-TJ-8).
The principles governing the techniques used in the coextrusion of two or more metals are discussed in general, and the application of these principles to the fabrication of zirconium-clad uranium fuel elements having integral zirconium end seals is discussed in detail. The extrusion billet consists of a uranium or uranium alloy core surrounded by a zirconium or Zircaloy-2 sleeve and end pieces (cladding); the core and cladding components are enclosed in an evacuated, sealed copper can and extruded. Special precautions to obtain good bonds between core and cladding, uniform cladding, and satisfactory interfaces between core and end seals are described. Specific techniques, component design, billet design, extrusion conditions, and a description of the resultant product obtained (clad rod or tube) are given for the zirconium or Zircaloy-2 cladding of unalloyed uranium, uranium–2% zirconium, uranium–10% molybdenum, uranium–4% silicon, and uranium–5% zirconium–1.5% niobium. (auth)

9428 TID-7546(p.182-227)
France. Commissariat à l'Énergie Atomique, Paris.
FABRICATION OF THE FOURTH SET OF FUEL ELEMENTS FOR THE EXPERIMENTAL PILE EL2. C. Ringot. p.182-227 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 46p.
The fabrication is described in detail. Topics covered are: the binding problem, the connection between can and rod, the basic materials: uranium, cans, and canning operations and welding, manufacturing controls, and mounting in the reactor. The various processes and pieces of equipment are illustrated. (M.H.R.)

9429 TID-7546(p.231-42)
Sylvania-Corning Nuclear Corp., Bayside, N. Y.
RECENT DEVELOPMENTS IN DISPERSION TYPE FUEL ELEMENTS. Bernard Kopelman. p.231-42 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 12p.
Considerable interest has centered around dispersion type fuel elements because they offer possibilities of performance not readily achievable in solid homogeneous fuels. Among these advantages are the possibilities of operation at high temperatures, high burn-ups, and the ability to withstand various corrosion conditions. A wide variety of dispersant fuel materials are described as well as matrix materials to contain the fuel. The important factors governing the selection of both fuel and matrix are discussed. Descriptions are given of the various techniques for preparing the fuel particles, including those for uranium oxide. In addition, descriptions are given of various combinations of fuel and matrix which have been studied and the results obtained therefrom. Because of the wide variety of possible fuel materials, as well as matrices in which these fuels can be dispersed, it is suggested that there is hardly a solid reactor fuel whose requirements cannot be met by the use of the dispersant type fuel. (auth)

9430 TID-7546(p.243-68)
Oak Ridge National Lab., Tenn.
FUEL DISPERSION IN STAINLESS-STEEL COMPONENTS FOR POWER REACTORS. J. E. Cunningham, R. J. Beaver, and R. C. Waugh. p.243-68 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 26p.
The development of cheap and reliable stainless-steel components containing highly enriched UO_2 has made possible the construction of power-producing reactors of compact-core design and high-operating-performance characteristics. The selection of the materials for this type of fuel component; the powder metallurgical processing required; methods that may be used to fabricate composite plates, wires, pins, and tubes; and the manufacturing characteristics of this fuel dispersion in stainless steel are discussed. Joining of the basic composite part is described briefly, with emphasis on brazing methods. Pertinent property data are also listed. (auth)

9431 TID-7546(p.269-97)
Oak Ridge National Lab., Tenn.
FUEL DISPERSIONS IN ALUMINUM-BASE ELEMENTS FOR RESEARCH REACTORS. J. E. Cunningham, R. J. Beaver, W. C. Thurber, and R. C. Waugh. p.269-97 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 29p.
The utilization of 20% enriched fuel in the manufacture of aluminum-base plate type fuel elements, designed for service in high-performance research reactors is discussed. The fabrication problems imposed by limiting the enrichment of fuel available for export to less than the 20% level are fully described. Potential uranium-bearing compounds for incorporating the fuel, in the form of either an alloy or as a dispersion in aluminum powder, are tabulated and some of the important factors to be considered in their evaluation are discussed. Because of the large fraction of intermetallic compound present, uranium–aluminum alloys containing upward of 40 wt. % uranium are inherently brittle and difficult to fabricate. Alloying studies, however, reveal that the structure of these alloys can be modified by ternary additions of silicon, tin, germanium, zirconium, and titanium. A 3 wt. % silicon addition, for instance, is sufficient to completely suppress the formation of the equilibrium compound UAl_4 in a 48 wt. % uranium–aluminum alloy and permit the primary nucleating compound $U(Al–Si)_3$ to be retained as a stable phase at room temperature. The beneficial effect of the silicon addition on grain size, conventional tensile properties, and formability is demonstrated. Fabrication procedures for preparing fuel plates containing a high uranium investment are described. Preliminary results of studies underway to determine the compatibility of uranium oxides and carbides in contact with aluminum at 600°C are reported. (auth)

9432 TID-7546(p.298-301)
[United Kingdom Atomic Energy Authority]. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
MANUFACTURE OF DIDO FUEL ELEMENTS. H. Lloyd.

p.298-301 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 4p.

The fuel-plate fabrication and fuel-element assembly are described. Each fuel plate contains 10 g of U^{235} in a uranium–aluminum alloy that is clad in aluminum. (M.H.R.)

9433 TID-7546(p.302-65)
Battelle Memorial Inst., Columbus, Ohio.
THE METALLURGY AND FABRICATION OF URANIUM-ALLOY FUEL ELEMENTS. R. W. Dayton. p.302-65 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 63p.

Uranium fuel alloys are discussed which have received considerable attention for use in power reactors. The alloy types discussed include the so-called "alpha-prime" alloys (containing 3 to 7 wt. % niobium and zirconium), gamma-phase alloys (containing 10 to 20 wt. % molybdenum or niobium), and epsilon-phase alloys (containing 3.8 wt. % silicon or 45 to 80 wt. % zirconium). Each of these alloys has unique characteristics which dictate the methods that are used to process it to fuel elements. These characteristics are discussed, as are the processing methods suitable for each alloy. The fabrication methods discussed are induction and arc melting for alloy preparation and brazing, roll bonding, and pressure bonding for cladding the fuel alloys. The discussion is confined to cladding with zirconium alloys metallurgically bonded. Brief mention is made of end capping by welding. Other fabrication techniques which are not unique are not considered. A summary of basic metallurgical information on the fuel alloys is added to provide background for the discussion of fabrication. (auth)

9434 TID-7546(p.369-83)
Mallinckrodt Chemical Works, St. Louis.
PREPARATION AND PROPERTIES OF URANIUM DIOXIDE POWDER. C. D. Harrington. p.369-83 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 15p.

The physical properties of UO_2 powder are discussed in relation to their importance in fuel-element application. Various methods of commercial preparation of the dioxide are described with particular emphasis on the two methods which have had the widest application in the actual production of the material for fuel-element raw material. Data are presented showing the relation between method of manufacture and properties of interest. (auth)

9435 TID-7546(p.384-401)
Atomic Energy of Canada Ltd. [Chalk River Project], Chalk River, Ont.
PRODUCTION OF URANIUM DIOXIDE FOR CERAMIC FUELS. L. C. Watson. p.384-401 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 18p.
Also issued separately as CRL-45 (AECL-515).

9436 TID-7546(p.402-13)
Aktiebolaget Atomenergi, Stockholm.
SINTERING OF URANIUM DIOXIDE. R. Kiessling and U. Runfors. p.402-13 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 12p.

The qualifications for sintered compacts of UO_2 used as simple fuel elements for subcritical assemblies are listed, along with additional problems which need to be solved. Figures illustrating the influence of shape and size of agglomerates on the properties of the sintered product are shown. Some general conclusions from the work done are drawn. (M.H.R.)

9437 TID-7546(p.414-31)
[General Electric Co.] Hanford Atomic Products Operation, Richland, Wash.
FABRICATION AND ENCLOSURE OF URANIUM DIOXIDE. E. A. Evans. p.414-31 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 18p.

Uranium dioxide compacts of high density can be economically produced by conventional ceramic processes such as cold pressing, isostatic pressing, hot pressing, extrusion, and slip casting. Greatly reduced costs and improved quality have been made possible by new powder treatments and fabrication techniques. Typical of the recent developments are (1) powder activation by reduction in a fluidized bed, (2) combined powder compaction and cladding by swaging, without subsequent sintering, and (3) finishing of sintered ware by belt centerless grinding. To overcome the disadvantage of poor neutron economy, UO_2 fuel assemblies require not only high-density oxide but also an efficient arrangement of the fuel. It is now economically feasible to fabricate UO_2 cores for relatively simple fuel assemblies which will meet this requirement. Problems of providing safe, durable, and economical enclosures for UO_2 fuel cores are rapidly being solved. Techniques have been developed for forming and assembling tubing, end fittings, and supporting members from alloys of zirconium, iron, and aluminum. Less conventional techniques, such as vacuum casting of zirconium alloys and high-frequency welding, are being studied. Standardization of fabricating processes and fuel-element designs is an extremely desirable objective which will be partially realized as the operating behavior of UO_2 fuel elements becomes better understood. (auth)

9438 TID-7546(p.432-41)
[United Kingdom Atomic Energy Authority.] Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
URANIUM DIOXIDE AS A REACTOR FUEL. P. Murray, S. F. Pugh, and J. Williams. p.432-41 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 10p.

The preparation, properties, and some aspects of the behavior under irradiation of nonstoichiometric uranium dioxide are described. An attempt is made to relate the changes observed under irradiation with the differences in physical and mechanical properties. (M.H.R.)

9439 TID-7546(p.442-515)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PROPERTIES OF URANIUM DIOXIDE. J. Belle and B. Lustman. p.442-515 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 74p.
Also issued separately as WAPD-184.

9440 TID-7546(p.516-25)
Aktiebolaget Atomenergi, Stockholm.
THERMAL CONDUCTIVITY OF URANIUM DIOXIDE. Jan E. Flinta. p.516-25 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 10p.

The thermal conductivity of UO_2, an early product sintered in a carbon furnace, has been measured up to 1800°C in connection with the high rate of heat transfer. This temperature is the average between two thermocouples in the radial heat-flow direction. The thermocouples used were the tungsten-molybdenum combination in the inner hottest positions and platinum-platinum/rhodium in the outer hole. Insulation for the thermocouples was made of MgO, which limited the temperature to about 2200°C, which is the melting point of the UO_2–MgO. ThO_2 was successfully tried as an insulator for the continued experiments. (auth)

9441 TID-7546(p.526-48)
Argonne National Lab., Lemont, Ill.
CERAMIC FUEL ELEMENTS IN THE ThO_2–UO_2 AND UO_2–PuO_2 SYSTEMS. J. H. Handwerk. p.526-48 [of]

FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 23p.

The techniques for forming solid solutions in either the ThO_2-UO_2 or UO_2-PuO_2 system are summarized. Solid solutions in the ThO_2-UO_2 system can be formed and fabricated by sintering mixtures of ThO_2 and U_3O_8. The resultant ware was found to have good density and appeared to resist damage from irradiation and corrosion by water. The manufacture of one ThO_2-UO_2 solid-solution composition for the BORAX-IV fuel elements is discussed. The procedures for forming the UO_2-PuO_2 solid solutions are given, and the preliminary irradiation studies are discussed. (auth)

9442 TID-7546(p.549-53)

Division of Research, AEC.

URANIUM COMPOUNDS FOR NEW HIGH-TEMPERATURE FUELS. E. Epremian. p.549-53 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 5p.

The trend in nuclear reactors is toward higher temperature operation, and, since uranium and its lower alloys suffer a gross swelling at elevated temperatures due to the accumulation of fission gases, solid fuels in reactors of the future will utilize higher alloy content or, alternatively, consist of uranium compounds. An exploratory program is now in progress to study various compounds as potential high-temperature fuels. Following a review of the desirable characteristics of such a material, the information available to date is summarized and discussed. The materials being studied include uranium carbides, silicides, nitride, sulfide, beryllide, and others. It is too early to state which, if any, of these materials will compare favorably with UO_2, which appears to be the best high-temperature fuel at the present time. (auth)

9443 TID-7546(p.554-62)

United Kingdom Atomic Energy Authority.] Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

DISPERSION TYPE FUEL ELEMENTS BASED ON FISSILE CERAMICS. J. Williams. p.554-62 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 9p.

The dispersants discussed are the oxides and carbides of Pu and U; the dispersal mediums dealt with are both ceramic and metallic. It is concluded that unless metals of neutron-absorption cross section ~1 barn can be accepted, there are no metal matrices that will offer a fuel element capable of prolonged operation above 600°C. The use of such relatively high cross-section matrices would probably be more attractive nuclear-wise using plutonium rather than U^{235} as the fissile element. The beryllium–uranium oxide system would appear to offer the maximum operating temperature of dispersions in low cross-section metals. For operating temperatures in excess of 600°C, using either uranium dioxide or uranium monocarbide as the disperse phase, an impermeable matrix is needed to retain the fission-product gases. (M.H.R.)

9444 TID-7546(p.565-87)

Atomics International [Div., North American Aviation, Inc.], Canoga Park, Calif.

CORROSION OF URANIUM, THORIUM, AND URANIUM ALLOYS IN SODIUM AND ORGANICS. Harry Pearlman. p.565-87 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 23p. (NAA-SR-Memo-2169).

Sodium and sodium-potassium alloys and the polyphenyl class of organic compounds possess certain advantages over water for use as reactor coolants. There are no reactions between uranium and the pure liquid metals; but thermodynamic data predict that formation of uranium carbide and uranium hydride is possible in reactions with organics and with their pyrolytic and radiolytic products. Available experimental data are reviewed for uranium and uranium alloys exposed both to sodium and sodium-potassium alloys in static and dynamic systems. Effects of irradiation on corrosion rate do not appear to be significant. The observed corrosion rate of uranium and uranium alloys depends very strongly on the impurity, especially oxygen, content of the liquid metal. In capsule type static corrosion experiments, made with liquid metal with oxygen content near 0.01 wt. % (100 ppm), corrosion rates are of the order of 10 mg/cm^2-month at temperatures up to 750°C. UO_2 and UO have been identified as corrosion products. In dynamic systems, corrosion rates of more than 600 mg/cm^2-month have been observed at 500°C, with oxygen content ranging near 0.005 wt. % (50 ppm). Corrosion rates of uranium and uranium alloys in purified biphenyl are of the order of 1 mg/cm^2-month at temperatures up to 400°C in static systems. Under dynamic conditions in loop experiments, rates are perhaps five times greater. Formation of UC, through UH_3 as an inferred intermediary, has been observed in monoisopropyl biphenyl under hydrogen gas pressures of the order of 100 psi. Impurities dissolved in the organic, such as air, oxygen, or water, greatly accelerate the corrosion rate. It is concluded that the corrosion rate of uranium and its alloys in liquid sodium and NaK is low enough to permit the use of a static liquid metal bond between the fuel and a cladding of some other metal. Exposure of relatively large surfaces of fuel to circulating liquid metal coolant appears not feasible, because of the difficulty of adequate control of oxygen in a large volume liquid metal system. There would be no advantage in reactor performance in direct exposure of unclad fuel to an organic coolant; but, in case of accidental exposure by way of a cladding failure, the corrosive attack would be relatively very slow. (auth)

9445 TID-7546(p.591-615)

[General Electric Co.] Hanford Atomic Products Operation, Richland, Wash.

IRRADIATION EFFECTS IN URANIUM. S. H. Bush. p.591-615 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 25p. (HW-51444).

A review of pertinent physical metallurgical properties of irradiated uranium is presented. Included under mechanical properties are hardness, bend, and tensile data. In the case of tensile properties the variables considered are burn-up, irradiation temperature, U^{235} content, composition (to 3 wt. % alloy), postirradiation annealing, and tensile testing temperature. Drastic reductions in ductility occur at burnups as low as 0.02 at. %. Recovery of damage is limited on postirradiation annealing. Changes in such physical properties as density, thermal conductivity, electrical resistivity, and modulus of elasticity are reported. Thermal conductivity decreases 10 to 15% at nominal burnups. The effect of irradiation on the microstructure of uranium is reported. Macroscopic, optical and electron microscopic, and fractographic results are presented. Precipitation, microcracking, and microbrittleness were detected. Solid-state studies, including recrystallization and solid and noble-gas diffusion, are reported. No direct evidence of a change in diffusion due to irradiation has been obtained. Structural changes were observed by means of x-ray diffraction; line broadening, line asymmetry, and some line shift were observed. Dimensional instability of uranium is discussed; typical results and possible mechanisms advanced to explain these results are reported. The impact of these changes in physical metallurgical properties on the behavior of uranium fuel elements is discussed. (auth)

9446 TID-7546(p.616-716)
[Westinghouse Electric Corp.] Bettis Plant, Pittsburgh.
EFFECTS OF IRRADIATION ON BULK URANIUM DIOXIDE.
J. D. Eichenberg, P. W. Frank, T. J. Kisiel, B. Lustman, and K. H. Vogel. p.616-716 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 101p.
This is a revised version of WAPD-183.

9447 TID-7546(p.717-47)
Knolls Atomic Power Lab., Schenectady, N. Y.
IRRADIATION BEHAVIOR OF DISPERSION FUELS.
D. W. White, A. P. Beard, and A. H. Willis. p.717-47 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 31p. (KAPL-P-1849).
Also issued separately as KAPL-1909.

9448 TID-7546(p.751-77)
Argonne National Lab., Lemont, Ill.
FAST REACTOR FUEL DEVELOPMENT AT ARGONNE NATIONAL LABORATORY. L. R. Kelman. p.751-77 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 27p. (ANL-FGF-73(Del.)).

Plutonium-239 is the favored fuel for fast neutron power-breeder reactors. However, its unattractive properties make it extremely unlikely that the unalloyed metal will find use as a fuel. Heat-transfer considerations and the limitations of normal fabrication methods suggest that the plutonium be diluted by alloying to make it usable in fast breeder reactors. The degree of dilution necessary makes plutonium the minor element, and therefore its undesirable properties no longer manifest themselves. However, the precautions necessary for safe handling of intense alpha emitters still apply. EBR-I, a relatively small experimental reactor facility, has had two complete fuel loadings, and a third loading has been fabricated. All three loadings used U^{235} as the fuel. The first loading consisted of heat-treated wrought unalloyed uranium slugs, and the second consisted of centrifugally cast uranium–2 wt. % zirconium alloy slugs. For both of these loadings a column of short fuel slugs fit loosely into a stainless-steel jacket with liquid NaK as the thermal bond. An incident which resulted in partial melting of the second loading has led to a more rigid design for the third loading so as to prevent bowing of the fuel rods. It is made by coextrusion and consists of a uranium–wt. % zirconium core metallurgically bonded to a Zircaloy jacket. EBR-II, a prototype fast power-breeder reactor, has a fuel element that is designed for high thermal performance and high burn-up. Long thin fuel pins fit loosely into a thin-walled tube with liquid sodium as the thermal bond. The simple design lends itself to a simple remote reprocessing cycle. EBR-II has been designed to receive a plutonium fuel at the earliest possible loading, and present plans are to fuel with plutonium the full size power-breeder reactor that will be developed from EBR-II's findings. A promising plutonium alloy is being developed and appears to satisfy EBR-II fuel-element requirements. Because this element is still being tested, EBR-II will be fueled at first with U^{235}. The alloys that have been developed for EBR-II fuel elements result from a combination of reactor physics, reactor engineering, reprocessing, and metallurgical requirements. Diluting the fissionable material helps the heat-transfer problem, and, by using U^{238} as the diluent, some internal breeding is also achieved. The metallurgical refining process that is integral with the EBR-II does not remove certain fission-product elements (referred to as fissium or Fs), and this determines to a considerable degree the fuel alloy composition. Some of these tend to stabilize the gamma phase of uranium and are therefore desirable alloying elements. The Pu^{239} alloy consists of uranium–20 wt. % plutonium–10 wt. % fissium with about 20 wt. % U^{235} included because of the relatively small reactor core size; the full size power reactor will require less than 20 wt. % plutonium and no U^{235}. The non-plutonium first loading consists of a uranium–5 wt. % fissium alloy with 49% enrichment. The uranium–plutonium–fissium alloys that were studied showed practically no irradiation damage effects and rate as the best uranium alloys ever studied at ANL. The uranium–5 wt. % fissium alloy that will be used at first in EBR-II also behaves well under irradiation. In general the studies indicate that alloying to stabilize the gamma structure of uranium is effective in improving irradiation stability. These alloys also possess excellent thermal cycling stability; they can be remotely injection cast into long, small diameter pins; they resist attack by the liquid sodium thermal bond, and are compatible with the reprocessing cell environment; and they have reasonable thermal expansion characteristics. A limitation is that they are poor thermal conductors. (auth)

9449 TID-7546(p.778-88)
Atomic Energy of Canada Ltd. [Chalk River Project], Chalk River, Ont.
PREPARATION AND SHEATHING OF PLUTONIUM–ALUMINUM FUEL ALLOYS FOR THE NRX REACTOR.
O. J. C. Runnalls and K. L. Wauchope. p.778-88 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 11p.
Also issued separately as CRL-47(AECL-514).

9450 TID-7546(p.789-811)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PLUTONIUM–ALUMINUM FUEL-ELEMENT DEVELOPMENT. M. D. Freshley. p.789-811 [of] FUEL ELEMENTS CONFERENCE, PARIS, NOVEMBER 18-23, 1957. 23p. (HW-52457).

Techniques and facilities for handling plutonium at several laboratories in the U. S. are described. Hazards involved in the handling of fissionable and highly toxic material are discussed, and the procedures used to guarantee the safety of laboratory personnel are described. The tentative aluminum-plutonium phase diagram prepared by Los Alamos for compositions ranging from 50 to 100 at. % aluminum is presented. This system is similar to the aluminum-uranium system; the alloys, however, have a greater tendency to segregate upon casting. A eutectic is formed at 1.7 at. % plutonium, and no solid solubility of plutonium in aluminum is observed. A brief description of the Plutonium Recycle Program at Hanford and their experience and future plans with the use of aluminum-plutonium alloys as reactor fuel materials are reported. Aluminum-plutonium fuel-element experience at the Chalk River Project in Canada, as well as the fabrication of the "napkin" rings by Los Alamos and Argonne, and the fabrication of Materials Testing Reactor type fuel assemblies containing aluminum-plutonium alloys by Los Alamos and the Oak Ridge National Laboratory are also discussed. From the limited amount of irradiation experience gained with this fuel material, there has been no indication of dimensional instability, and there have been no indications of unsatisfactory performance caused by reactor irradiation. Even though the health hazard associated with plutonium makes its handling more difficult, safe and economically feasible solutions to fuel-element fabrication problems do exist. Further developments on the utilization of plutonium as a reactor fuel material will increase the world supply of fissionable material and contribute to the peaceful application of nuclear energy throughout the world. (auth)

9451 WAPD-176
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
KINETIC AND BUCKLING MEASUREMENTS ON LAT-

TICES OF SLIGHTLY ENRICHED URANIUM OR UO_2 RODS IN LIGHT WATER. J. R. Brown, D. R. Harris, F. S. Frantz, J. J. Volpe, J. C. Andrews, and B. H. Noordhoff. Jan. 1958. 67p. Contract AT-11-1-GEN-14. $2.00(OTS).

Results of measurements made in the TRX critical facility on light water-moderated lattices of 1.3 and 1.15 wt. % enriched uranium metal fuel rods and of 1.3 wt. % enriched UO_2 fuel rods are described. Diameters of 0.60 in. and 0.39 in. for each fuel have been used as well as densities of 7.5 and 10.5 gm/cm^3 for the UO_2 fuel. Several water-to-uranium ratios have been investigated for each fuel rod type. Measurements have been made of radial and axial buckling, reflector savings, and temperature coefficient of reactivity. A migration area is inferred from the change of reactivity with change in either radial buckling or axial buckling. Anisotropy of migration area is determined from measurements of buckling on lattices of various height-to-diameter ratios. (auth)

9452 WAPD-PWR-CP-2629

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. REMOVAL OF BORIC ACID FOLLOWING CHEMICAL SHUTDOWN OF PWR. W. T. Lindsay, Jr. Nov. 30, 1956. 6p. $1.80(ph OTS); $1.80(mf OTS).

Information about the cost and time required for removal of boric acid from the Shippingport Pressurized Water Reactor primary coolant after chemical shutdown is submitted. Two concentrations of boric acid corresponding to 0.227 and 0.0454 g atoms B/liter coolant are considered, and it is desired to reduce the concentration to 2.27×10^{-4} g atoms B/liter or less. Results are given for combinations of bleed and feed removal followed by polishing by purification system operation for final reduction of the concentration. The minimum fixed costs will be $2400 since all procedures will fully exhaust two 12 ft^3 ion exchange beds in the waste disposal system. (W.D.M.)

9453 WAPD-PWR-PMF-898

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. DYNAMIC PRESSURE TESTS. J. C. Rengel. Sept. 28, 1957. 11p. $3.30(ph OTS); $2.40(mf OTS).

Included with this report is letter of transmittal (WAPD-PWR-PMF-914) dated Oct. 9, 1957, with Westinghouse Sketch PFS-40, "Dynamic Pressure Transients from Main Coolant Check Valve Slam." 2p.

A series of tests were conducted on the PWR plant to determine the magnitude and characteristics of any hydraulic transients that might be encountered as a result of check value slamming during main coolant pump switching operations. Results are presented. (W.L.H.)

9454 WAPD-TH-414

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.] FUEL ELEMENT TEMPERATURE RESPONSE IN THE "BEYOND BURNOUT" HEAT TRANSFER REGION. S. J. Green and J. S. Williams, Jr. Apr. 24, 1958. 10p. $1.80 (ph OTS); $1.80(mf OTS).

The possible plate temperature responses associated with transient operation in this region are qualitatively examined. The steady state surface heat flux is shown as a function of fuel element surface temperature and local coolant enthalpy. Four regions of different heat transfer mechanisms are identified. The analysis indicates that accidents involving increasing heat generation will not allow fuel element temperature arrestment in the proposed extended operating rate without a power decrease. However, for accidents involving decreasing generation rates it may be possible in some cases to proceed to fuel temperatures "beyond burnout" and subsequently return to a nucleate boiling condition. (M.H.R.)

9455

ROLLING MILLS FOR FUEL ELEMENTS. 2. A. I. Nussbaum (Stanat Mfg. Co., Inc., Westbury, N. Y.). Atomics and Nuclear Energy 9, 128-30, 146(1958) Apr.

The fabrication sequence and types of mills employed in the fabrication of fuel elements are described. (J.S.R.)

9456

MEASURING RESONANCE ABSORPTION OF NEUTRONS IN HETEROGENEOUS U/D_2O SYSTEMS. V. F. Belkin, P. A. Krupchitskii, and Yu. V. Orlov. Atomnaya Energiya 3, No. 10, 320-2(1957).

Into a tank filled with D_2O various uranium systems (square lattices with a = 10.0, 6.3, and 3.4 cm; uranium rod diameter 1.75, 1.1, and 0.568 cm) could be fitted. Besides, a uranium converted of ϕ = 3 cm, H = 10 cm was fitted into the center which was irradiated with slow neutrons of the Russian heavy water reactor. Indium foils, packed in cadmium holders, were used as neutron detectors. The expression $\Psi S_3 \rho^{-3/5}$ for the uranium–D_2O system is, as measured by this method, lower than in the case of measurement by other methods. Furthermore, the ratio of the neutron density in the lattice center, opposite to the surface of the uranium rods, was measured for a uranium–D_2O system (f_U) as also for a Pb–D_2O system (f_{Pb}). An average value of 0.050 ± 0.015 was obtained for $f_U - f_{Pb}$. It was found that by the introduction of a scattering substance (Pb) in the lattice the uniform distribution of neutron density is disturbed. The density on the surface of the uranium rods is lower than in the center of the lattice. (TCO)

9457

PROBLEMS OF REACTOR CONTROL. K. Fuchs. Atomwirtschaft 3, 157-61(1958) Apr. (In German)

The way in which a reactor acts during its starting period can with sufficient safety be calculated by approximation. The transition phenomena of the output n(t) and log n(t) at sudden changes of reactivity are of interest for the technical evaluation of the control of the various starting methods, from manual to automatic start. It is shown which points must be considered when a starting system is designed and which types of control are specially suitable. (auth)

9458

SPECIAL CONSTRUCTION PROBLEMS IN ATOMIC POWER PLANTS. W. Stürmer. Atomwirtschaft 3, 165-7 (1958) Apr. (In German)

Radioactive radiation, neutron flux, and temperature level of heat generation mainly govern the new construction problems which must be considered during the erection of a nuclear power station. By examples it is shown how at different types of plants the demarcation and shielding of the radiation, the balancing between internal design of reactor and cooling system with neutron flux, the lay-out of the heat exchanger circuit and the leak tightness, especially of the pump circuits and fittings, can be achieved. (auth)

9459

ATOMIC ECONOMY NEEDS NEW INDUSTRIAL MATERIALS. G. Matz. Atomwirtschaft 3, 171-3(1958). (In German)

Reactor materials fitted at inaccessible spots inside nuclear reactors must, without maintenance, withstand the existing conditions during the lifetime of the reactor. They must therefore meet specially high quality and processing requirements. Further special demands are added because of neutron absorption, nuclear purity, radiation resistance, and activation. For these reasons the interest in some hitherto less known materials such as zirconium, beryllium, heavy water, titanium, niobium, and hafnium is in-

creasing. The selection, manufacture, and processing of conventional materials must be considered from new points of view. (auth)

9460

NUCLEAR POWER PLANT INSTRUMENTATION. R. C. Faught, Jr. (General Electric Co., Schenectady, N. Y.). Elec. Engr. 76, 1046-51(1957) Dec.

Nuclear power plant instrumentation systems and detector requirements and designs are emphasized. Some of the sodium- and water-coolant system characteristics that influence instrument design are discussed. (M.H.R.)

9461

THE SUB-CRITICAL FACILITY FOR MERLIN. Nuclear Eng. 3, 198-202(1958) May.

To provide physics data for the Merlin core, a versatile sub-critical facility has been built at the A.E.I. Research Laboratories at Aldermaston. The design of this facility provides an elegant solution to the problem of satisfying the requirements of an extensive research program in absolute safety. (auth)

9462

HARWELL WIGNER RELEASE, FIRST SINCE WINDSCALE. Nuclear Power 3, 230(1958) May.

A new method of releasing stored energy was recently carried out on BEPO at Harwell. Instead of making the reactor critical with no coolant flow, the air was preheated, while the reactor was kept running at a very low power level. The release was started by switching on 750 kw of heating grids installed in the air inlet duct and reducing the flow to 5% of normal. The graphite was heated to 90°C where the temperature then jumped up in some places by as much as 200°C in five minutes. The maximum temperature reached in the graphite was 330°C. After 26 hr the temperature was falling steadily in all parts of the reactor, and the release was considered at an end. (W.D.M.)

9463

CONTROL ROD DRIVE MECHANISM ON THE EBWR. C. F. Bullinger and W. J. Kann (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 379-86(1958) Apr.

The control rod drive mechanisms installed on the Argonne Experimental Boiling Water Reactor (EBWR) are of an externally operated lead screw and nut type in which the control rod extension shafts are driven through pressure breakdown, collected leakage seals. The mechanisms which are located below the reactor are fabricated from conventional industrial materials, such as carbon steel, brass, cast iron, nylon, etc., and are lubricated with grease. They may be serviced during reactor operation, and are removable from the reactor without the necessity of draining the reactor vessel. This feature has proven to be worthwhile in operation. The mechanism is adaptable to reactors operating at pressures up to 1500 psi and requiring up to a 6-foot control rod stroke. This paper describes the development of the mechanism, the final design and proof-testing program, and some of the particular design difficulties encountered. Some of the other drive types, including electromagnetic jack, hydraulic, and rotary seal rack-and-pinion, considered for EBWR application, are also discussed. (auth)

9464

CONTROL ROD CALCULATIONS FOR DETERMINATION OF REACTIVITY AND POWER DISTRIBUTION. P. Greebler (General Electric Co., San Jose, Calif.). Nuclear Sci. and Eng. 3, 445-55(1958) Apr.

Thermal and epithermal absorption of neutrons by a cylindrical control rod are computed using two-group diffusion theory and assuming a flat source distribution for the epithermal group. Hurwitz-Roe area rule concepts are modified to take into account the nonthermal absorption by the rod and are extended to include rods that are not "black." The effect of the control rod on the neutron economy is averaged over a cylindrical cell surrounding the rod and is expressed in terms of two-group absorption cross sections. Control rod power perturbations in a reactor are calculated from the two-group flux distributions in the cell containing the centered control rod. (auth)

9465

GENERAL SOLUTION OF THE REACTOR KINETIC EQUATIONS WITHOUT FEEDBACK. Ziya Akcasu (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 3, 456-67(1958) Apr.

Kinetic equations without the thermal feedback are integrated for an arbitrary reactivity variation, assuming that the magnitude of the changes in the excess reactivity is less than one dollar. First and second approximations are obtained. The results are applied to the step, ramp, and periodical reactivity changes. It is found that the logarithm of the flux, in the first approximation, is given by the function which is the solution of the linearized kinetic equations for the flux. Hence, the usual transfer function approach can be used to form the first approximate solution of the nonlinear kinetic equations. The wave form of the flux is obtained for a sinusoidal input, and the second harmonic is calculated. The exponential rise in the average value, as well as in the amplitude, of the oscillations of the flux is given for an alternative reactivity input. The gain of the reactor is defined. It is shown that the relative gain of the reactor decreases slightly with the increasing amplitude of the sinusoidal input. The results are compared to a numerical solution obtained by AVIDAC. (auth)

9466

ON THE THEORY OF STOCHASTIC PROCESSES IN NUCLEAR REACTORS. L. Pál (Hungarian Academy of Sciences, Budapest). Nuovo cimento (10) 7, Suppl. No. 1, 25-42(1958).

The fundamental equations describing the stochastic processes in reactors are formulated in the most general manner, and the generalized equations for the neutron density and neutron importance, as well as for the fluctuation of neutron density, are derived. The equations for neutron density and those for neutron importance are in close relation with certain generalized forms of the Kolmogoroff-Feller equations from the theory of stochastic processes. Only one type of fissionable nucleus is considered in this treatment. (W.D.M.)

9467

REACTOR CORE MATERIALS. Technical Progress Review, Vol. 1, No. 1. Columbus, Battelle Memorial Institute, 1958. 42p. Available from U. S. Government Printing Office, Washington for $0.55.

Current studies directed toward knowledge of physical properties, heat treatment, and irradiation behavior of U and constitutional-diagram studies and corrosion, radiation effects, and dimensional-stability tests of alpha-uranium alloys are reported. Recent developments in the fields of gamma-phase, epsilon-phase, and dilute U, Pu, and Th alloys and ceramic and dispersion fuels are summarized briefly. Information is given on the following moderator materials: graphite, Be metal and alloys, BeO, and calcium, niobium, and zirconium hydrides. Control materials considered are: Ag–In–Cd alloys, B alloys, rare-earth alloys, and dispersion control materials. Special fabrication techniques discussed briefly are: melting, extrusion and forging, roll cladding, vapor-deposited coatings, electrodeposited coatings, enamels and electrophoretic coatings, welding and brazing methods, and nondestructive testing. Studies on the corrosion of cladding materials: Zr, Al, Nb, Mo, Cr, and Ni, and on corrosion

mechanisms of fuel alloys and metal-water reactions are reported. Radiation effects studies in fuel and nonfuel materials are also included. Extensive bibliographies are given. (M.H.R.)

9468

POWER REACTOR TECHNOLOGY. Technical Progress Review, Vol. 1, No. 2. Dunedin, General Nuclear Engineering Corp., 1958. 72p. Available from U. S. Government Printing Office, Washington for $0.55.

Pertinent data from current studies in reactor development are reviewed. The subjects covered are: reactor physics, reactor dynamics and safety, fuel elements and other reactor materials, fuel cycles, Pu recycle, fluid fuels, UO_2–NaK slurry, components, aqueous homogeneous reactors, pressurized water reactors, boiling water reactors, fast reactors, organic moderated reactors, gas cooled reactors, and molten fluoride reactors. Extensive bibliographies are included. (M.H.R.)

Nuclear Transformation

9469

THE POLARIZATION OF γ-RADIATION OCCURING IN THE REACTION $Si^{30}(p,\gamma)P^{31}$. P. M. Tutakin, S. P. Tsytko, A. N. L'vov, and A. K. Val'ter. Atomnaya Energiya 3, No. 10, 336-8(1957).

The γ radiation observed with the decay of the excited state with 8.2 Mev energy ($J = 3/2$) in P^{31} into the ground state ($J = 1/2+$) is distinctly polarized. From the experimentally determined angular distribution of the photoprotons there follows $(R-1) = -0.51$ or $R = 0.49$. The γ transition 8.2 Mev belongs to the M_1 type, and therefore the level must have 8.2 Mev, spin and parity $3/2+$. The angular distribution of the 8.2 Mev γ transition has the form $\omega(\vartheta) \sim 1 - a_2 \cos^2 \vartheta$ with $a_2 = -0.34 \pm 0.12$, from which it follows that the 8.2 Mev must be a mixture of $M_1 + E_2$. (TCO)

9470

INVESTIGATION OF THE ANGULAR DISTRIBUTION OF TRITONS PRODUCED BY DEUTERONS OF ABOUT 0.9 Mev ON BERYLLIUM. Jurić K. Mira and Zarubica N. Dragica. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 8, 17-22(1958) Mar.

The angular distribution of tritons from the reaction $Be^9(d,t)Be^8$ and the triton yield compared with the yield of protons from $Be^9(d,p)Be^{10}$ reaction were investigated at deuteron energies of 636, 653, 697, 826, 869, 908, 920, and 993 kev. (The incident energies were determined with an error of 3%.) (auth)

9471

FORMATION OF SILVER^{103} BY BOMBARDMENT OF ENRICHED CADMIUM^{106} WITH PROTONS. B. C. Haldar and Edwin O. Wiig (Univ. of Rochester, N. Y.). J. Indian Chem. Soc. 35, 79-80(1958) Jan.

Enriched Cd^{106}, in the form of CdO and $CdNH_4PO_4 \cdot H_2O$, was bombarded for one hour with protons of 60 and 40 Mev. Natural cadmium metal was also bombarded at 60 Mev. After bombardment, the silver was separated and counted with a beta proportional counter, a scintillation counter, and an x-ray proportional counter. The silver activity from the enriched targets was found to decay with half lives of 18 min, 27 min, 1.1 hr, and 5.2 hr. The 18 min activity was probably associated with Ag^{102}, and the 27 min activity was caused by Ag^{106} or Ag^{104}. The 1.1 hr activity showed the radiation characteristics of Ag^{103}. The ratio of the Ag^{103} activities obtained at 60 Mev from enriched and normal cadmium, corrected for the difference in target material, was found to be 20 to 1 as compared with an enrichment factor of 27. It is concluded that the 1.1 hr activity was produced from Cd^{106} and a (p,α) reaction on Cd was suggested. (J.S.R.)

9472

PROTONS AND ALPHA-PARTICLES FROM THE NITROGEN BOMBARDMENT OF ALUMINIUM. A. Zucker (Oak Ridge National Lab., Tenn.). Nuclear Phys. 6, 420-33 (1958) Apr. (1).

Aluminum targets, about 0.36 mg/cm^2 thick, were bombarded with 28-Mev nitrogen ions. The compound nucleus Ca^{41} is excited to 39.3 Mev and may decay by proton emission to K^{40}, and by alpha emission to Ar^{37}. Energy distributions for protons and alpha particles were measured at six angles from 0° to 90°. The number of protons or alphas per unit beam, divided by the channel energy and the capture cross section, plotted as a function of the square root of the excitation energy in the residual nucleus yields a value of a in the level density formula $w = C \exp[2(aE)^{1/2}]$. The data fit this formula well at all angles giving $a = 5.0 \pm 0.2$ for K^{40}, and $a = 4.1 \pm 0.3$ for Ar^{37}. Angular distributions were also measured and are reasonably isotropic for protons, whereas they show a definite forward peak for alpha particles. An even-odd effect was found in the level density of the residual nuclei, K^{40} having about 2.5 times the level density of Ar^{37}. In general, the nitrogen-aluminum reaction bears out the predictions of the statistical theory for the decay of a compound nucleus. (auth)

9473

THE ENERGY AND ANGULAR DISTRIBUTION OF PROTONS FROM 14 Mev NEUTRON REACTIONS WITH Cu. D. L. Allan (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 6, 464-76(1958) Apr. (1).

The energy and angular distributions of protons from the reactions $Cu^{63,65}(n,p)$ and $Cu^{63}(n,np)$ at 14 Mev have been determined. The energy distributions in the forward direction exhibit peaks spaced many times the known level spacing of the residual nuclei. The angular distributions are symmetrical about 90° only for protons in the energy interval 2 to 3 Mev; the angular distributions for other energy intervals show a forward asymmetry which increases progressively with proton energy. (auth)

9474

(γ,γ) ANGULAR CORRELATION IN THE REACTION $N^{14}(p,\gamma)O^{15}$. S. Gorodetzky, A. Gallmann, M. Croissiaux, and R. Armbruster (Institut de Recherches Nucléaires, Strasbourg). Nuclear Phys. 6, 517-24(1958) Apr. (1). (In French)

The $\gamma-\gamma$ angular correlation has been measured in two different planes in the cascade 8.34 Mev → 5.27 Mev → 0 of O^{15} through the $N^{14}(p,\gamma)O^{15}$ reaction, at its resonance at 1.060 Mev. The experimental results agree with the value $J = 3/2$ for the angular momentum of the 5.27-Mev level. The computations do not rule out the value $J = 5/2+$. (auth)

9475

UNIFIED NUCLEAR MODEL AND DIRECT NUCLEAR PHOTOEFFECT. I. WEAK COUPLING EFFECTS. J. Sawicki (Princeton Univ., N. J.). Nuclear Phys. 6, 525-30(1958) Apr. (1).

A contribution to the direct E1 nuclear photoeffect coming from the indirect interaction via the electric quadrupole moment of the core is discussed. The oscillating core absorbs the incoming γ ray and emits a surfon which is subsequently reabsorbed with the emission of the proton. The interference term between this two-stage mechanism contribution and the usual E1 amplitude in the angular distribution is estimated in two particular cases to amount to a large fraction of the usual E1 term. (auth)

9476
THE (γ,2n) AND (γ,3n) REACTIONS IN ^{181}Ta. J. H. Carver and W. Turchinetz (Australian National Univ., Canberra). Proc. Phys. Soc. (London) 71, 613-17(1958) Apr.

The Ta^{181}(γ,3n) reaction has been studied by measuring the 9.5 min and 150 min activities of Ta^{178}. The two Ta^{178} isomers are produced in the effectively constant ratio Ar(9.5 min)/Ar(150 min) = 3.0 ± 0.6 by gamma rays of all energies between 24 and 32 Mev. The experimental results have been combined with previous determinations of the Ta^{181}(γ,n) cross section and of the photo-neutron yield to obtain the relative cross sections for the Ta^{181}(γ,n), (γ,2n), and (γ,3n) reactions from their thresholds to 31 Mev. The integrated cross sections for the (γ,n), (γ,2n), and (γ,3n) reactions to 31 Mev are (73 ± 3)%, (24 ± 3)%, and (3.0 ± 1.2)% of the total integrated cross section, (3.3 ± 1.2) Mev barns, for these three photo-neutron reactions. (auth)

9477
ANGULAR DISTRIBUTIONS FOR SOME (d,p) REACTIONS. I. B. Teplov and B. A. Yur'ev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 334-40(1958) Feb. (In Russian)

The angular distributions of some proton groups produced by 4 Mev deuterons in (d,p) reactions on silicon, phosphorus, sulfur, and chlorine were determined. The results show that in those cases when the neutrons were captured with $l = 2$ the maximum of the differential cross section was displaced towards small angles with respect to the maximum computed from Butler's theory. Comparison of the angular distributions for the investigated reactions reveals that interference between the stripping reaction and formation of a compound nucleus exerts an appreciable influence on the shape of the angular distributions. (tr-auth)

9478
FISSION OF ROTATING NUCLEI. G. A. Pik-Pichak. Zhur. Eksptl'. i Teoret. Fiz. 34, 341-5(1958) Feb. (In Russian)

An expression has been obtained for the fission barrier of a rotating nucleus. The fission cross section is estimated for the reaction of N^{14} ions on heavy nuclei. (tr-auth)

9479
MEASUREMENT OF THE NEUTRON SPECTRA IN THE FISSION OF U^{233}, U^{235}, AND Pu^{239} IN THE RANGE 50 to 700 kev. V. P. Kovalev. Zhur. Eksptl'. i Teoret Fiz. 34, 501-2(1958) Feb. (In Russian)

The distribution of recoil neutron tracks stopping in the chamber gas at energies from 50 to 700 kev was calculated, and the spectra of neutrons in the fission of U^{233}, U^{235}, and Pu^{239} were measured with an experimental error of 10 to 20%. The ratio of the number of recoil protons in the energy range 0.05 to 0.6 Mev to their number at energies >0.6 Mev was determined. The experimental values obtained for the U^{233}, U^{235}, and Pu^{239} are 0.49 ± 0.04, 0.53 ± 0.04, and 0.48 ± 0.04, respectively. (R.V.J.)

9480
SYSTEMATISM OF THE AVERAGE NUMBER OF FISSION NEUTRONS ν. B. D. Kuz'minov and G. N. Smirenkin. Zhur. Eksptl'. i Teoret. Fiz. 34, 503-4(1958) Feb. (In Russian)

The number of prompt neutrons in fission, ν, was calculated, and the results were compared with the experimental data derived previously. Most of the experimental data is in good agreement with the results of the calculations with the exception of the ν for the spontaneous fission of U^{238}. The ν for the spontaneous fission of Th^{232} was not compared in view of the recent data which question the value $\nu_{Th}/\nu_{u} = 1.07 \pm 0.1$. (R.V.J.)

9481
DOUBLE DECAY OF Ca^{48}. V. B. Belyaev and B. N. Zakhar'ev (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 34, 505-6(1958) Feb. (In Russian)

The nuclear matrix element in double neutrino decay was calculated using the nuclear shell model approximations. The decay Ca^{48}–Ti^{48} was selected as the most suitable for double β decay. It was assumed that the transformation passes through the virtual intermediate state Sc^{48}. The nuclei Ca^{48}, Sc^{48}, and Ti^{48} all have a similar core Ca^{40} which is not participating in the β process, hence studies were concerned with 8 nucleons in each nucleus. The coinciding radial functions of the examined nuclei and filled or almost filled shells which do not require fractional parentage coefficients simplified the studies. Results indicated the half decay period of $\sim 10^{19}$ year with the correction number $\lambda \sim 0.01$. (R.V.J.)

9482
YIELD FROM THE (d,2n) REACTIONS IN THE CONTINUUM RANGE. O. Hittmair (Comisión Nacional de la Energía Atómica, Buenos Aires). Z. Physik 150, 648-52 (1958). (In German)

The energy value of the deuterons of a (d,2n) reaction lie for medium and heavy nuclei in the continuum range. The interaction of these deuterons with the initial nucleus proceeds either in the form of an intermediate nucleus formation by deuteron absorption or by (d,n) stripping, in which one or two neutrons are evaporated, or else in a direct form through a (p,n) surface reaction in which the proton of the deuteron is exchanged with a neutron of the initial nucleus. The effective cross section of these reaction forms were calculated. A comparison with experiment gave an explanation on the preponderance of first one and then the other reaction mechanism, and a statement was made on the level thickness of the nucleus concerned and on the validity of the evaporation model. (tr-auth)

9483
YIELD FROM THE NUCLEAR REACTION $Al^{27}(d,2p)Mg^{27}$. R. Radicella, J. Rodriquez, G. B. Baró, and O. Hittmair (Comisión Nacional de la Energía Atómica, Buenos Aires). Z. Physik 150, 653-6(1958). (In German)

The total effective cross section of the reaction $Al^{27}(d,2p)Mg^{27}$ was determined by comparing the saturation activity with that of the simultaneous reaction $Al^{27}(d,p\alpha)Na^{24}$, whose effective cross section is known. The highest deuteron energy was 28 Mev. After a description of the irradiation and measurement techniques, the results obtained were discussed with respect to the reaction path. Of the existing possibilities, the total absorption of the deuteron with subsequent proton evaporation appears to be the preferable one. (tr-auth)

Particle Accelerators

Refer also to abstracts 9287 and 9336.

9484 CERN-58-3
European Organization for Nuclear Research, Geneva.
REMARKS ON DEPOLARIZATION EFFECTS IN A SOURCE OF POLARIZED PROTONS. Ch. Schlier. Mar. 15, 1958. 16p.

It is planned to construct a source of polarized protons to use with the CERN synchrocyclotron. To know the degree of polarization, it is necessary to investigate the depolarizing effects of collisions of the H atoms with other atoms, molecules, and the electrons in the ionizing region. These effects are considered theoretically and experimentally. (W.D.M.)

9485
PULSED BEAM DEFLECTION SYSTEM FOR A LINEAR ELECTRON ACCELERATOR. M. J. Poole, G. Dean, and

W. Howe (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Instr. 2, 282-6(1958) Apr.

A method has been developed to permit the simultaneous use of two targets with a pulsed linear electron accelerator. A magnet is arranged to deflect the beam onto one or the other target, and this magnet is electronically switched on or off in the interval between the beam pulses. A "count-down" circuit is used to select which pulses shall be directed to each target. (auth)

9486

THE THEORY OF ELECTRON MOTION IN CYCLIC ACCELERATORS IN PRESENCE OF RADIATION. A. A. Kolomenskij and A. N. Lebedev (P. N. Lebedev Inst. of Physics, Moscow). Nuovo cimento (10) 7, Suppl. No. 1, 43-60(1958).

Electron synchrotrons are essentially characterized by the presence of intensive relativistic electromagnetic radiation of electrons in the magnetic field of the accelerator. The power of this radiation rapidly increases with the increase of the electron energy. Consequently most of the power of the accelerating system is expended in compensating for radiation losses. Motion of electrons in an axially symmetrical accelerator in the presence of radiation is considered in terms of the vertical and radial oscillations and the radiation fluctuations. The damping of betatron oscillations in magnetic periodic systems and the effects of radiation fluctuations on betatron and synchrotron oscillations in magnetic periodic structures are discussed. (W.D.M.)

9487

ON THE THEORY OF A CIRCULAR PHASOTRON. A. K. Burtsev and A. A. Kolomenskiy. Pribory i Tek. Ekspt. No. 2, 11-15(1957).

The particle dynamics in the circular phasotron as compared with the well known strongly focusing synchrophasotron exhibit several peculiarities. In the present article an analysis is made of certain problems associated with the linear theory of betatron oscillations in the circular phasotron. From the analysis of the magnetic field of the phasotron the so called "similarity condition" is defined as $R_2/R_1 = n_2/n_1$. This condition is met only for a certain set of parameters, e.g., for $\sigma = \sqrt{s\nu}$. It is shown that the "similarity condition" restricts the choice of the working point in the stable region for given accelerator parameters. The peculiarity of the circular phasotron is the fact that conditions for r (radial) and z (vertical) oscillations are not equally important, which is due to the fact that the sector angles should not be equal to each other. The mean radius of the magnetic toroid increases to infinity for $\nu_1 \approx \nu_2$, and in general the stability region is asymmetrical with respect to the bisector of the coordinate angle in the σ_1, σ_2 plane. The amplitude of the betatron particle oscillations is characterized by the modulus of Flocquet function. It is shown that this amplitude increases sharply when the working point approaches the limit of the stability region $|\cos \mu_{r,z}| \sim 1$. The case of parametric resonances is analyzed. The equation for the allowable mean-square values of the field index n change, which leads to a resonant increase of the amplitude, is given and their numerical values computed for n = 70 and n = 50. The relative influence of "fringe" focusing and the influence of the use of linear gaps and fringes is discussed. The shape of the magnetic field is considered, and means of obtaining the necessary configuration are discussed. (TCO)

9488

THE INFLUENCE OF SCATTERING ON SYNCHRONOUS OSCILLATIONS OF PARTICLES IN ACCELERATORS. D. G. Koshkarev. Pribory i Tek. Ekspt. No. 2, 15-18 (1957).

In synchronous accelerators the elastic scattering of particles in the residual gas may be neglected, since the scattering influences only the betatron oscillations. The inelastic scattering leads to losses in the momentum of the accelerated particles, and, since the losses are finite, they influence the synchrotron oscillations. An analysis of this effect is given using the linear theory of synchrotron oscillations without taking into account the adiabatic attenuation. Formulas are derived for the evaluation of the percentage of lost particles and for the increase of the mean square amplitude of phase oscillations. It can be seen from the analysis that the losses occur mainly at low energies and that the magnitude of this effect depends on many parameters of the accelerator and does not exceed the magnitude of the effect introduced by elastic scattering. The analysis has been used in an experimental evaluation of the effect for the synchrophasotron of the Joint Institute of Nuclear Research of the Academy of Sciences USSR at 10 Bev and at a chamber pressure of 6×10^{-6} mm Hg. The computed losses give the figure of 30%. Since the exact evaluation of maximum amplitude of phase oscillations φ_{max} is not possible within the applied theory of linear approximation, a value of $\varphi_{max} = 0.7$ was assumed. (TCO)

Radiation Absorption and Scattering

9489 NP-6690

Du Pont de Nemours (E. I.) & Co. Radiation Physics Lab., Wilmington, Del.

ENERGY LOSS AND RANGE OF CHARGED PARTICLES IN ORGANIC SOLIDS AND ALUMINUM. Werner Brandt. Oct. 1957. 34p.

The calculated energy loss and range of heavy charged particles, electrons, and positrons in twelve organic solids and aluminum are tabulated for particle energies up to $E/M_0c^2 = 20$. The corresponding particle stopping times are estimated. The results are compared with available experimental data. (auth)

9490 NYO-2174

Rochester, N. Y. Univ.

POLARIZATION OF 5.7 MEV PROTONS ELASTICALLY SCATTERED FROM NICKEL. W. Parker Alford and Robert E. Warner. Mar. 19, 1958. 19p. Contract AT(30-1)-875. $3.30(ph OTS); $2.40(mf OTS).

A calculation of the scattering of 5.5-Mev protons from cobalt has been carried out. The calculated angular distribution is in fairly good agreement with experiment. The magnitude of the measured polarizations is consistent with calculations, but more accurate data are needed to provide any critical comparison between theory and experiment. (A.C.)

9491 ORNL-2516

Oak Ridge National Lab., Tenn.

TRIPLE CORRELATION. M. E. Rose. May 22, 1958. 62p. Contract W-7405-eng-26. $1.75(OTS).

The triple correlation function for three radiations in coincidence is presented for the general case of arbitrary mixtures in the angular momentum of the emitted (or absorbed) radiations. The properties of the relevant parameters and functions are described. The question of definition of the reduced matrix elements is also discussed. The form of the correlation function is such that by taking advantage of other existing tabulations of double correlation one need compute only the parameters characterizing the middle transition. Tables for these parameters are given. (auth)

9492

INEQUALITY RELATIONS FOR SCATTERING CROSS

SECTIONS. Hubert Reeves (Cornell Univ., Ithaca, N. Y.). Ann. Phys. (N. Y.) 3, 386-96(1958) Apr.

Use is made of a lemma by Erdös and Fuchs to derive various mathematical inequalities applicable to scattering and polarization cross sections, and the conditions under which they hold. They are compared to inequalities obtained by simpler methods. One possible application of these relations is to check whether a given set of experimental cross sections obeys these inequalities or not. If it does not, it is then known that the corresponding conditions are not fulfilled. The violation of these conditions would provide some information about the interaction. (auth)

9493

ANGULAR DISTRIBUTION OF 2.34 Mev NEUTRONS, SCATTERED ELASTICALLY AND INELASTICALLY BY CHROMIUM, IRON AND LEAD. O. A. Sal'nikov. Atomnaya Energiya 3, No. 8, 106-11(1957).

The following measurements were carried out: (a) Cross section of elastic scattering in barns: (E_n = 2.34 Mev)

	Cr	Fe	Pb
30°	10.2 ± 1.1	6.2 ± 0.8	20.4 ± 1.7
45°	6.3 ± 0.5	2.9 ± 0.3	7.7 ± 0.7
60°	1.9 ± 0.3	1.4 ± 0.2	2.6 ± 0.4
90°	1.3 ± 0.1	2.0 ± 0.3	4.3 ± 0.5
105°	1.8 ± 0.2	—	3.6 ± 0.4
135°	1.6 ± 0.2	1.4 ± 0.2	2.4 ± 0.2

(b) Cross section of inelastic scattering: (E_n = 2.34 Mev) Fe = 0.90 ± 0.07 b, Cr = 0.93 ± 0.08 b, and 0.53 Mev level of Pb = 0.80 ± 0.08 b and 0.805 to 0.890 Mev level of Pb = 1.08 ± 0.10 b. The angular distribution of the neutrons inelastically scattered by Fe, Cr, and the 0.53 Mev level of Pb is isotropic, whereas it is anisotropic for the unresolved levels of 0.805 to 0.890 Mev in Pb. (TCO)

9494

THE HYDRODYNAMIC DISTURBANCES FROM THE TRACKS OF THE IONIZING PARTICLES IN THE STABLE LIQUIDS. G. A. Askar'yan. Atomnaya Energiya 3, No. 8, 152-3(1957).

If an ionizing radiation penetrates the liquid, it is accompanied by an increase of the size of molecules, by microexplosions, with local heating along the traces of the particle. These processes may lead to the formation of empty places and may be germ cells for the vapor phase. They can, in turn, become centers of hydrodynamic disturbances. A mathematical formulation is given. (TCO)

9495

DEUTERON DISSOCIATION ON NUCLEAR SCATTERING. A. G. Sitenko. Atomnaya Energiya 3, No. 10, 324-5(1957).

The differential angular and energy distribution of neutrons and protons which are liberated with the dissociation of the deuteron are theoretically derived. An integration of this equation is, however, not possible for the general case. If $f_{eff} \ll \chi$ is true, three other equations for the momentum distribution of the neutrons and protons are given. (TCO)

9496

INELASTIC DEUTERON SCATTERING FROM CHROMIUM AND COBALT. F. A. El Bedewi and S. Tadros (Univ. of Alexandria, Egypt). Nuclear Phys. 6, 434-9(1958) Apr. (1).

A magnetic spectrograph with photographic detection is used to study the angular distribution of some deuteron groups inelastically scattered from chromium and cobalt. The incident deuterons have an energy of about 8.7 Mev. An observed level in Cr^{52} at 1.44 ± 0.02 Mev is found to have spin 2^+. Three levels in Co^{59} at 1.27 Mev, 1.54 Mev and 1.75 Mev, with errors of 0.02 Mev, are observed. The angular momentum transferred to this nucleus at the 1.27 Mev level is found to be 2 units. (auth)

9497

POLARIZATION OF PROTONS FROM THE d-d REACTION AT 1.2 Mev. Bogdan Maglić and Jovan Vuković (Inst. for Nuclear Sciences, "Boris Kidric," Belgrade). Nuclear Phys. 6, 443-5(1958) Apr. (1).

The protons emitted at 135° from the d-d reaction at 1.2 Mev enter a helium scattering chamber after passing through a 23 cm brass tube. To measure the asymmetry of the protons scattered in helium, two pairs of plates were placed at each of the two positions: azimuthal angle 0° and 180°. Proton energy at the moment of scattering was measured to be 2.05 ± 0.05 Mev. The data give for polarization P = 0.24 ± 0.08. (W.D.M.)

9498

INELASTIC SCATTERING OF 185 Mev PROTONS ON NUCLEI WITH MASSES FROM FLUORINE TO POTASSIUM. H. Tyrén and Th. A. J. Maris (Univ. of Uppsala). Nuclear Phys. 6, 446-50(1958) Apr. (1).

Inelastic spectra of 185 Mev protons scattered at two different angles on nuclei from the natural elements fluorine to potassium, neon excepted, are reported. Except for chlorine, measurements were made at one small angle to show the forward peaked excitations, and at a larger angle at which the forward dipped cross sections are more pronounced. The measured spectra are shown. (W.D.M.)

9499

THE INELASTIC SCATTERING OF PROTONS BY C^{12}. E. J. Squires (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 6, 504-16(1958) Apr. (1).

The differential cross section and polarization for the inelastic scattering of 180-Mev protons by C^{12} leaving the nucleus in the 4.43-Mev state are calculated, using shell model wavefunctions in the L-S and j-j coupling extremes and nucleon-nucleon phase shifts taken from an analysis of free nucleon-nucleon scattering, and taking the absorption part of the optical model potential into account. Good agreement is found when L-S coupling is used, especially when use is made of information obtained from inelastic electron scattering to obtain a correction to the nuclear matrix elements calculated with the crude shell model wavefunctions. Some discussion is given of the difference between polarization and asymmetry in inelastic scattering and it is shown that this difference is likely to be small. (auth)

9500

THE ELASTIC SCATTERING OF 350 Mev NEUTRONS BY COMPLEX NUCLEI. A. Ashmore, D. S. Mather, and S. K. Sen (Univ. of Liverpool). Proc. Phys. Soc. (London) 71, 552-64(1958) Apr.

Differential cross sections have been measured for the elastic scattering of neutrons with a mean energy of 351.5 ± 3 Mev by lead, tin, copper, aluminum, and carbon. Measurements were made out to the first diffraction minimum. The total elastic scattering cross sections subtracted from the total cross sections measured previously give upper limit values for the absorption cross sections. By comparison with other measurements the absorption cross sections are seen to be essentially constant from 140 Mev to 1.4 Bev. Values of the radius of the black disk, giving an angular distribution which, when normalized, fits the experimental points, are found to be in agreement with those deduced from measurements of high energy electron scattering. From the values of the forward scattering cross sections and the previously measured values of the total cross sections, it is found that within the accuracy of the measurement the forward scattering amplitude is purely imaginary. (auth)

9501
ELASTIC SCATTERING OF 350 Mev NEUTRONS BY COMPLEX NUCLEI. G. E. Brown, A. Ashmore, and R. Nordhagen (Univ. of Birmingham, Eng. and Univ. of Liverpool). Proc. Phys. Soc. (London) 71, 565-73(1958) Apr.

The scattering of 350 Mev neutrons by lead and carbon is analyzed using the optical model. The parameters of the latter are determined as well as possible. The problem of the unambiguous determination of optical model parameters is considered in detail for the high energy region. (auth)

9502
DISTORTED WAVE APPROXIMATION IN THE REACTION $P + P \rightarrow \pi^+ + D$. B. Durney (University Coll., London). Proc. Phys. Soc. (London) 71, 654-7(1958) Apr.

The improvement in the agreement between theory and experiment in the threshold region of π^+-meson production from proton–proton collisions is shown to be independent of any detailed model of the meson–nucleon interaction in the final state. The distorted wave approximation applied to the resonant scattering state gives a marked increase in the production cross section over the cross section calculated in Born approximation. (auth)

9503
SCATTERING OF X-RAYS AND THERMAL NEUTRONS BY SINGLE COMPONENT CRYSTALS NEAR PHASE TRANSITION POINTS OF THE SECOND KIND. M. A. Krivoglaz (Inst. of Physics of Metals, Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 405-11 (1958) Feb. (In Russian)

Peculiarities of scattering of x rays and thermal neutrons by single-component crystals near phase transition points of the second kind are investigated. Geometric distortions of the crystal lattice connected with fluctuations of internal parameters characterizing long-range order are taken into account explicitly. The general case is considered when long-range order is characterized not by one but by several parameters. Account of geometric distortions may significantly modify the qualitative pattern of the diffuse scattering intensity in space of the reciprocal lattice. In particular terms may arise which are inversely proportional to the square of the distance from the node of the reciprocal lattice, that is, terms which tend to infinity as the nodes are approached. Near phase transition points of the second kind singularities can be observed in the distribution of diffuse scattering in the neighborhood of superstructural reflections as well as near the main regular reflections. The nature of the dependence of the scattering intensity on temperature and on the position in the space of the reciprocal lattice significantly depends on the crystal symmetry. Ferroelectric crystals are considered in greater detail. In this case parameters determining the intensity of diffuse scattering near nodes in the space of the reciprocal lattice can be determined by independent experiments. (auth)

9504
APPLICATION OF DISPERSION RELATIONS TO π–N SCATTERING AT LOW ENERGIES. L. L. Lapidus (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 34, 453-52(1958) Feb. (In Russian)

Consequences of the dispersion relations for π–N-scattering at low energies are considered without making recourse to Low type equations. Relations between the scattering lengths in various states are deduced from the derivatives of the dispersion relations at $k^2 = 0$. (tr-auth)

9505
THE THEORY OF DISPERSION RELATIONS. S. M. Bilen'skii (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 34, 518-19(1958) Feb. (In Russian)

9506
THE NON-SIMILARITY OF PHASES IN THE SCATTERING OF NUCLEONS BY NUCLEONS. L. G. Zastavenko, R. M. Ryndin, and Chzhou Guan-Chzhao (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 34, 526-7(1958) Feb. (In Russian)

Radiation Effects

9507 HW-47776
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RADIATION DAMAGE TO GRAPHITE FROM 30°C–185°C. R. E. Nightingale and J. F. Fletcher. June 10, 1957. Decl. Aug. 20, 1957. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Property changes in polycrystalline graphite resulting from reactor irradiations at temperatures up to 185°C and over a range of exposures up to 1135 Mwd/ct have been determined. Of the properties measured, changes in stored energy, thermal conductivity, sample length, and C_0 interlayer crystallite spacing are markedly decreased as exposure temperature is increased. Electrical resistivity changes are also less at higher exposure temperatures, but this property change does not depend as strongly on temperature as the others. Isothermal annealing studies of C_0 changes were conducted on a number of irradiated samples. The data were analyzed assuming a large number of processes distributed in activation energy. The results are summarized in activation energy spectra in which the distribution of C_0 damage is given as a function of the activation energy required for annealing. It is found that not only does a higher exposure temperature decrease the total amount of property change, but also the distribution of damage accumulated is considerably different. (auth)

Radioactivity

9508 CEA-671
France. Commissariat à l'Énergie Atomique, Paris.
ÉTUDE DU RAYONNEMENT γ DES BARRES D'URANIUM EN COURS DE DÉSACTIVATION. (Study of γ Radiation from Uranium rods during Deactivation.) F. Balestic. April 25, 1957. 13p.

The classical formulas giving the γ activities of the fission products contained in a uranium rod after unloading from the pile are reviewed without being proved. The knowledge of these activities makes it possible, by means of the method proposed, to determine the intensities of ionization at a point outside the rod, and thus to establish γ radiation diagrams. The different parameters introduced in the calculation are geometric (dimensions of the bars and coordinates of the point considered), energetic (power at which the bar has been irradiated), and temporal (duration of the irradiation and deactivation). A numerical example follows the demonstration of the general formulas. Gamma flux measurements carried out in the deactivation well of P2 (Saclay pile) define the accuracy of the method. In conclusion, it is suggested that radiation diagrams be used in planning the use of industrial irradiators for radiochemical polymerization or the preservation of food products. (auth)

9509 NP-6691
Grumman Aircraft Engineering Corp., Bethpage, N. Y.
SEAPLANE HULL BOTTOM NEUTRON ACTIVATION

STUDY. Bi-Monthly Progress Report No. 3. M. Zizza. Mar. 1958. 13p. Contract NOas-57-622. (RE-86-PR-3).

The period since the release of the second progress report on the Neutron Activation Study of Seaplane Hull Bottom Materials has been spent in carrying out experimental work at Brookhaven and in analysis of the data collected. A series of specimen irradiations were made and the specific radioisotopes that led to the total activity of a specimen were identified as aluminum-28, sodium-24, manganese-56, magnesium-27, nickel-65, and zinc-69. The specimens prepared for irradiation were typical of the structural materials used in the hull bottoms of modern seaplanes. Aluminum alloy 2014 was used as the base material with a number of surfacing substances such as paints, primers, tapes, sealants, and sea water residue added as modifications. A gamma ray spectrometer was used for detecting and identifying the radioisotopes in the irradiated specimens. Procedures were established for arriving at the counting efficiency of the spectrometer as a function of the incident gamma ray. For this purpose samples of manganese-56, gold-198, and cobalt-60 were used as calibration standards. As a result of the specimen irradiations and data reductions now completed several conclusions become apparent: (1) the surfacing materials associated with the hull bottom, such as paints, primers, sea water residue, etc., contribute very little to the total activity of the specimens themselves; (2) the relative quantities of activities resulting from (n,p) and (n,α) reactions are appreciable when a predominantly fast neutron flux is employed for activation purposes; and (3) the effect of increased irradiation time on specimen activity is not pronounced. (For preceding period see NP-6507.) (auth)

9510

THE QUALITY OF IRIDIUM GAMMA-RAYS WITHIN A SCATTERING MEDIUM. J. L. Haybittle (Addenbrooke's Hospital, Cambridge, Eng.). Acta Radiol. 49, 246-8(1958) Mar.

Measurements with aluminum and graphite chambers have been made to compare the quality of 220 kv iridium γ-rays within a scattering medium with the quality of roentgen rays under the same conditions. The results show that the energy absorption in the inorganic matrix of bone surrounded by soft tissue is appreciably less with iridium γ-rays than with 220 kv roentgen-rays. (auth)

9511

PURE BETA-EMITTER ISOTOPES IN THE PRODUCTION OF SELF-LUMINOUS COMPOUNDS. A Breccia and E. Lazzarini (Istituto di Fisica del Politecnico, Milan). Energia nucleare (Milan) 5, 261-4(1958) Apr.

Research work was performed for the purpose of establishing whether self-luminous compounds would be obtainable for practical applications from a phosphor ZnS type and a beta-radioactive nuclide compound mixed with polystyrene. The quantity of beta-activity necessary to obtain a certain brightness from P^{32} measured in μ-lamberts was determined on a sample containing 40% ZnS and 60% polystyrene. (auth)

9512

POLARIZATION OF X-RAY QUANTA AND NON-CONSERVATION OF PARITY IN K-CAPTURE. A. Z. Dolginov (Physico-Tech. Inst. of the USSR Academy of Sciences, Leningrad). Nuclear Phys. 6, 460-3(1958) Apr. (1).

The effect of parity non-conservation in β interaction on the correlation between circular polarization of x-ray quanta emitted by an atom after K capture and polarization of nuclear spins or of subsequent nuclear quanta is considered. L capture is examined and it is shown that in capture from the L_{III} shell the angular distribution of x-ray quanta is anisotropic. (auth)

Rare Earths and Rare-earth Compounds

9513

THE STRUCTURES OF LANTHANUM DICARBIDE AND SESQUICARBIDE BY X-RAY AND NEUTRON DIFFRACTION. Masao Atoji, Karl Gschneidner, Jr., A. H. Daane, R. E. Rundle, and F. H. Spedding (Iowa State Coll., Ames). J. Am. Chem. Soc. 80, 1804-8(1958) Apr. 20.

Lanthanum dicarbide, with a structure of the calcium carbide type is body-centered tetragonal, a = 3.934 ± 0.002 Å., c = 6.572 ± 0.003 Å. The C−C distance of the C_2 group is 1.28 ± 0.02 Å., intermediate between double and triple bond C−C distances. Lanthanum sesquicarbide is body-centered cubic with the plutonium sesquicarbide ($D5_c$-type) structure, and a lattice constant between 8.803 and 8.819 Å. It also contains C_2 groups but with a C−C distance (1.32 ± 0.03 Å.) about that of a double bond. A possible relation between electron density and C−C distance is noted. Carbon positions in both structures were determined by neutron powder data, and were refined by a statistical method based on the least squares method. (auth)

9514

COULOMB EXCITATION CROSS SECTIONS OF GADOLINIUM ISOTOPES FROM INELASTIC SCATTERING MEASUREMENTS. V. Ramsak, M. C. Olesen, and B. Elbek (Univ. of Copenhagen). Nuclear Phys. 6, 451-9 (1958) Apr. (1).

The cross sections for Coulomb excitation and the energies of the accessible low-lying rotational states in the six most abundant isotopes of gadolinium have been determined from measurements on the corresponding groups of inelastically scattered protons and deuterons. The projectiles were accelerated in an electrostatic generator to energies around 4 Mev. Particles scattered from isotopically pure targets prepared in an isotope separator were observed at an angle of 145° with respect to the beam by means of a magnetic spectrometer of high resolution. The lifetimes for the first excited states in Gd^{154} and Gd^{156} derived from the measured cross sections are in good agreement with the reported directly measured lifetimes of these states. (auth)

9515

ZEEMAN EFFECT AND ANALYSIS OF THE SPECTRUM OF TRIVALENT SAMARIUM IN SINGLE CRYSTALS WITH VARYING SYMMETRIES. H. Lämmermann (Technischen Hochschule, Darmstadt, Germany). Z. Physik 150, 551-72(1958). (In German)

The absorption spectra of Sm^{3+} ions in samarium ethyl sulfate, samarium chloride, and samarium nitrate were taken in polarized light between 4.2 and 80°K with high dispersion and in an external magnetic field of varying size and direction. From the ground term and seven excited terms the value of the crystal quantum numbers and the J value were obtained. In the ethyl sulfate the g factors and in the chloride the reciprocal splitting ellipsoid of five terms are determined. The g factors react sensitively to the weak mixture of states with various J values in the crystal field. With single terms the reciprocal splitting ellipsoids degenerate to even pairs, from which the presence of a pseudohexagonal axis of the crystal field perpendicular to A_2^z was explained. (tr-auth)

Spectroscopy

Refer also to abstract 9515.

9516 DP-274

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

SLIT SERVO FOR SINGLE-BEAM SPECTROMETER.

Woodfin E. Shuler. Mar. 1958. 9p. Contract AT(07-2)-1. $0.50(OTS).

A servomechanism has been designed and constructed that adjusts automatically the slit width of a single-beam spectrometer to yield a base line of constant signal. (auth)

9517 ORNL-2319

Oak Ridge National Lab., Tenn.

A COMPILATION OF DATA ON SOME SPECTRA OF THORIUM. G. W. Charles. May 22, 1958. 161p. Contract [W-7405-eng-26]. $3.00(OTS).

A compilation of available data on the spectra of thorium is presented, including energy levels and classified lines with Zeeman effects and isotope shifts, as well as certain data on unclassified lines. The present status of knowledge of these spectra is discussed. (auth)

9518 AEC-tr-3245

THE CONTINUOUS AND CONTINUOUSLY-DISCRETE X-RAY SPECTRUM (ACCORDING TO KRAMERS' THEORY AND ACCORDING TO WAVE MECHANICS). A. W. Maue. Translated from Ann. Physik (5), 13, 161-90(1932). 35p.

Intensity formulas in accordance with wave mechanics and in accordance with Kramers' theory are derived. The limit region of the continuous and continuously discrete spectra is discussed. The results of both theories on the radiation intensity and polarization are compared. The special case of slow electrons, the case of fast electrons, and the long wavelength edge region of the continuous spectrum are treated. Graphic examples are presented. A correspondence theory of Wentzel and an astrophysical application of Kramers' theory are discussed. (W.D.M.)

9519 AEC-tr-3248

METHODS AND EQUIPMENT FOR LONG-WAVE INFRARED SPECTROSCOPY. N. G. Iaroslavskii. Translated from Uspekhi Fiz. Nauk 62, 159-86(1957). 39p.

An attempt was made to systematize the information relating to methods of long-wave infrared spectroscopy and the equipment developed in recent times for producing and recording spectra in the wavelength region up to 1600 μ. (W.D.M.)

9520 NP-tr-75

THE EFFECTIVE CROSS-SECTIONS OF ATOMS FOR EXCITATION OF SPECTRA. S. E. Frish. Translated by R. C. Murray from Uspekhi Fiz. Nauk 61, 461-90(1957). 44p.

Atoms are transformed from the i-th energy level to a higher one, the k-th, through collision with electrons of a certain velocity. The effective cross section for this process is measured by determining the number of excitations of an atom from the i-th to the k-th state from the intensity of the spectral lines emitted in these transitions. (W.D.M.)

9521 NP-tr-77

THE CALCULATION OF ATOMIC WAVE FUNCTIONS AND OSCILLATOR STRENGTHS WITH AN ELECTRONIC COMPUTER. L. A. Vainshtein. Translated by L. Bovey from Optika i Spektroskopiya 3, 313-21(1957). 14p.

The use of semi-empirical methods for the calculation of the radial functions of atomic electrons is discussed. A new variation of the method is proposed in which the atom-core field is expressed as linearly deformed wave functions based on Fock's equation. The method is used for the calculation on an electronic computer of both atomic wave functions and oscillator strengths of Na, K, Cs, Mg, Ca, Hg, Cd, He and O. It is shown that for the field calculation, simple analytical functions can be used. In some cases the computed oscillator strengths differ considerably from the experimental values; possible reasons for these discrepancies are discussed. (auth)

9522

AN IRONLESS β-SPECTROMETER WITH DOUBLE FOCUSING. V. F. Baranov. Atomnaya Energiya 3, No. 8, 170-1 (1957).

A β spectrometer of the $\pi\sqrt{2}$ type was built from a number of coils without iron cores. The field produced by the coils causes spatial focusing of the first grade as well as that of the second grade, which is characterized by the coefficients $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$. As the field is created without iron, there exists a rigorous even proportionality between the energy of the electrons to be focused and the coil current. The electron orbit has a radius of 100 mm. The broadening of the electron beam amounts to ± 10% in a radial direction and to ± 6% in axial direction. As a maximum, electrons can be measured up to 0.3 Mev. The F-line of Pb^{212} has a half-width of 0.58% in the case of a fully utilized solid angle of 0.6%. The width of the source is 1.5 mm, and the rectangular aperture before the hanger is 1.2 mm. The spectrometer has a maximum Ø of 400 mm, a height of 200 mm, and a weight of 40 kg. (TCO)

9523

STUDIES OF ELECTRON FOCUSING IN TWO-LENS β SPECTROMETER. K. P. Mitrofanov and V. S. Shpinel (Lomonosov Moscow State Univ.). Izvest. Akad. Nauk. S.S.S.R. 21, No. 12, 1607-13(1957) Dec. (In Russian)

Focusing properties of a two-lens β spectrometer at various lens positions and the influence of an external corrective spool were studied. The scheme of the apparatus with an improved electron gun and shifting inlet diaphragm permitting variation of the electron emission angle without disturbing the vacuum is shown. Graphs are given of β spectrometer spherical abberations at various lens positions. Electron trajectories in the spectrometer are given. (R.V.J.)

9524

PRELIMINARY MEASUREMENTS OF SOME WAVELENGTHS OF KRYPTON 86 AND MERCURY 198 LINES. K. M. Baird and D. S. Smith (National Research Council, Ottawa, Ont., Can.). J. Opt. Soc. Amer. 48, 300-1(1958) May.

Vacuum wavelength values for some of the lines in the spectra of Kr86 and Hg198 have been derived by comparison with a Michelson type Cadmium lamp, by using a 67.5-mm Fabry-Perot etalon as the intermediary. The same lines have been intercompared by means of a Twyman-Green interferometer, referring to the Hg198 green line wavelength as 5462.2704A. The half-widths of the lines were also measured. (auth)

9525

SPECTROSCOPIC ISOTOPE SHIFT IN LEAD. II. F. E. Geiger, Jr. (Univ. of Wisconsin, Madison). J. Opt. Soc. Amer. 48, 302-3(1958) May.

An investigation is made of the spectroscopic isotope shift in the Pb II visible spectrum by using enriched isotopes. The isotope structure of Pb^{204}, Pb^{206}, and Pb^{208}, and the hyperfine structure of Pb^{207} in the transitions; 15,011 cm^{-1} ($6s^2\ 7s\ ^2S_{1/2} - 6s^2\ 7p\ ^2P_{1/2}^{\circ}$), 17,824 cm^{-1} ($6s^2\ 7p\ ^2S_{1/2} - 6s^2\ 7p\ ^2P_{3/2}^{\circ}$), 18,032 cm^{-1} ($6s^2\ 7p\ ^2P_{3/2}^{\circ} - 6s^2\ 7d\ ^2D_{5/2}$), 18,609 cm^{-1} ($6s\ 6p^2\ ^4P_{5/2} - 6s^2\ 5f\ ^2F_{7/2}^{\circ}$) are analyzed with a Fabry-Perot interferometer crossed with a constant-deviation Hilger spectrograph. The samples are excited in a Schüller hollow cathode discharge tube. Spacings between consecutive even isotopes, (205−206), (206−208), the centroid of the odd isotope and the isotope 208 ($207_{c.g.}-208$), and the ratios (204−206)/(206−208), ($206-207_{c.g.}$)/($207_{c.g.}-208$) are given. (auth)

9526

ABSORPTION AND LUMINESCENCE SPECTRA OF K Br−In PHOSPHOR AND THE CHANGES INDUCED BY

X RADIATION. M. L. Katz and V. K. Nikol'skii (Saratov State Univ.). Optika i Spektroscopiya 4, 354-7(1958) Mar. (In Russian)

It is shown that the activation ions In^+ and Sn^+ possessing isoelectronic shells induce similar absorption, excitation, and luminescence spectra in the activated single crystals of KBr. Such similarity suggests that the absorption processes of these phosphors must be related to the electron transitions between the displaced levels of activation ions. The changes induced in the absorption spectra by x rays are caused by the formation of atomic centers which have been formed during the capture of free electrons by the activation ions. (tr-auth)

Theoretical Physics

9527

THE USE OF PROJECTION OPERATORS IN THE CONFIGURATION INTERACTION PROBLEM. R. K. Nesbet (Massachusetts Inst. of Tech., Lexington). Ann. Phys. (N. Y.) 3, 397-407(1958) Apr.

Matrix elements of the many-particle Hamiltonian, for atomic, molecular, or nuclear wave function calculations, can be reduced from quadratic to linear forms by the use of totally antisymmetric basis functions which result from applying projection operators to single determinants. The projection operators select components with definite transformation properties under symmetry operations of the invariance group of the Hamiltonian. It is shown that the projected functions need to be known only up to an undetermined numerical factor in order to determine matrix elements between the corresponding normalized functions. A method is given for constructing such projected determinants from any orthonormal set of totally antisymmetric functions with the same transformation properties under the symmetry group. To complete the presentation of a self-contained, practicable, and reasonably efficient method for evaluating the general configuration interaction matrix element, a minimal set of linear equations are stated which determine the transformation coefficients that completely reduce the representation of an arbitrary symmetry group. (auth)

9528

ON A NON-LINEAR THEORY OF PARTICLES WITH SPIN 1. Kuo-Hsien Tzou. Compt. rend. 246, 1815-17(1958) Mar. 24. (In French)

A non-linear theory of particles with spin 1, proposed in a previous article (Compt. rend. 245, 289(1957)), is defined so that it is compatible and applicable to the case of charged and neutral particles. (tr-auth)

9529

ON THE THEORY OF PERTURBATIONS FOR BOUND STATES. Claude Bloch (Centre d'Etudes Nucléaires, Saclay). Nuclear Phys. 6, 329-47(1958) Apr. (1). (In French)

Two methods leading to general prescriptions for the construction of the time-independent perturbation expansions for bound states to all orders are discussed. The two methods differ by the choice of the zeroth-order wave functions. In both cases, the expansions are simplified by the use of non-orthonormalized zeroth-order wave functions. The terms of the expansions are described by means of diagrams. The accuracy of the expansions is tested by a calculation of two eigen-values of the Mathieu equation. (auth)

9530

NEW WAVE EQUATIONS FOR ELEMENTARY PARTICLES. Yasuhisa Murai (Univ. of Manchester, Eng.). Nuclear Phys. 6, 489-503(1958) Apr. (1).

An interpretation is given of the equation which was proposed by Umezawa and Visconti for isomerization of particles of non-zero mass. The deduction of the equation is done by extending the definition of equivalent observers and introducing a new variable. The latter procedure is necessary to reconcile the extended definition of equivalent observers with the classical law of inertia, and it can be done in a unique way. (auth)

9531

SYMMETRICAL STRUCTURE AND CONSERVATION RELATIONS OF FOUR-COMPONENT NEUTRINO FIELD. Takehiko Takabayasi (Institut Henri Poincaré, Paris). Nuclear Phys. 6, 477-88(1958) Apr. (1).

A four-component spinor field with zero rest-mass ψ is represented as the field defined by its modulus ρ, an orthogonal frame in two-dimensional internal space, and a Lorentz frame in 4-dimensional internal space. This representation manifests the perfect isotropic property of the field in both internal spaces. In fact, the neutrino equation is invariant under arbitrary rotations in those internal spaces, which are conversely expressible by a certain four-component spinor ζ. As the result of these new invariance properties the neutrino field is shown to satisfy several conservation relations that are vector or tensor equations with respect to both internal spaces. They contain, besides the conventional ones, a number of new conservation laws. (auth)

9532

PARITY NON-CONSERVATION AND TRANSVERSE POLARIZATION OF β-PARTICLES: ADDED REMARKS. G. Györgyi (Central Research Inst. for Physics, Budapest) and H. Überall (CERN, Geneva). Nuclear Phys. 6, 539-40 (1958) Apr. (1).

It is pointed out that the transverse β polarization can be useful for a direct determination of the neutrino handedness, a principle which is related to Goldhaber's method insofar as it also requires a knowledge of the recoil, but the application of which is not limited to K-capture processes leading to an excited daughter nucleus. (W.D.M.)

9533

POLARIZATION IN STRIPPING REACTIONS. H. C. Newns and M. Y. Refai (Univ. of Liverpool). Proc. Phys. Soc. (London) 71, 627-32(1958) Apr.

Recent experimental results make a new discussion of the mechanism of this reaction necessary. A classical discussion is presented and the conclusions confirmed by quantum mechanical claculations at rather low energies. The qualitative features of the reaction seem now to be understood. (auth)

9534

DOUBLE SCATTERING EXPERIMENTS AS A TEST FOR INVARIANCE UNDER TIME-REVERSAL IN STRONG INTERACTIONS. F. Mandl (Atomic Energy Research Establishment, Harwell, Berks., Eng.). Proc. Phys. Soc. (London) 71, 686-7(1958) Apr.

The polarization-asymmetry equality in double scattering experiments derived by Dalitz (1952) and Wolfenstein and Ashkin (1952) depends on invariance under time reversal (T) of the scattering matrix. When suitably stated, it is independent of parity conservation. Hence an experimental test of this equality is a direct test of T invariance in strong interactions. In order to interpret such an experiment one would like to know to how large an admixture of T-violating terms an observed polarization-asymmetry difference P−A corresponds. This point is discussed for pp-scattering. (A.C.)

9535

A MODEL IN GENERAL RELATIVITY FOR THE INSTANTANEOUS TRANSFORMATION OF A MASSIVE

PARTICLE INTO RADIATION. J. L. Synge (Dublin Inst. for Advanced Studies). Proc. Roy. Irish Acad. 59, Sect. A, No. 1, 1-13(1957) Dec.

A special problem is dealt with which is an extreme idealization of the problem of a radiating star, the star in this case a mathematical point with mass, instantaneously converted into a thin shell of radiation. It is possible that this may be a useful model for the discussion of the rapid conversion of a star into radiation, or, on the microscopic scale, for the conversion of ultimate particles into radiation. The paper is regarded as a mathematical contribution to the theory of Einstein's field equations, because it adds another to the not very extensive lists of exact solutions of those equations. It differs from the others in the use of null coördinates instead of the traditional (r,t) coördinates. (W.D.M.)

9536

QUANTIZING OF FIELDS WITH ZERO MASS. PART I. TENSORIAL FIELDS. C. G. Bollini. Publs. com. nacl. energía atómica (Buenos Aires) Ser. fis. 1, No. 15, 263-74(1957). (In Spanish)

From the equations describing the supplementary conditions which ensure that the theory of the field of an elementary particle with zero mass and integral spin is based on an irreducible representation of particles with unit spin, the independent components of the tensor field are extracted and the supplementary equations are quantized. The commutation relations which result are compatible with the supplementary conditions. (J.S.R.)

9537

APPLICATION OF COLLECTIVE VARIABLES AND ACCOUNT OF SHORT RANGE FORCES IN THE THEORY OF A SYSTEM OF CHARGED PARTICLES. I. R. Yukhnovskii (L'vov State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 34, 379-89(1958) Feb. (In Russian)

The free energy and distribution function (binary and ternary) of charged particle systems are computed with account of short range forces. The corresponding expressions are written down in the form of a series in group integrals (correlations). It is shown that for electron plasma in a compensating field the Coulomb potential does not lead to divergencies in the expressions for the free energy or the distribution functions. The total free energy of a system of particles with a Coulomb interaction potential is also computed. The "transition function" for such systems is set up. (auth)

9538

SOME REMARKS ON THE COMPOUND MODEL OF ELEMENTARY PARTICLES. L. B. Okun. Zhur. Eksptl'. i Teoret. Fiz. 34, 469-76(1958) Feb. (In Russian)

Some properties are considered of the compound model of elementary particles in which Λ hyperons and nucleons are assumed to be the primary particles. (tr-auth)

9539

THE QUANTUM KINETIC EQUATION FOR A MULTICOMPONENT SYSTEM OF CHARGED PARTICLES. S. V. Temko. Zhur. Eksptl'. i Teoret. Fiz. 34, 523-4(1958) Feb. (In Russian)

9540

A RANKING OF THE SINGLE TERMS IN WEAK INTERACTIONS. W. R. Theis (Universität, Hamburg). Z. Physik 150, 590-2(1958). (In German)

The theory is advanced that a two-component formulation without the Dirac equation is an adequate description for weak interactions with parity violation. (J.S.R.)

9541

NOTE ON RELATIVISTIC COULOMB WAVE FUNCTIONS. J. D. Jackson and H. W. Wyld, Jr. (Univ. of Illinois, Urbana) and S. B. Treiman (Princeton Univ., N. J.). Z. Physik 150, 640-7(1958).

Some results on the wave functions of a Dirac particle in a point charge Coulomb field are presented. Angular momentum and parity eigenfunctions are tabulated and used to construct solutions representing asymptotically a plane wave plus incoming or outgoing spherical waves. The solutions for $r \to 0$ are exhibited in a form closely similar to the corresponding free particle spinors and are used to construct generalizations of the Casimir projection operators for positive or negative energy particles. The various wave functions presented are useful in calculations such as nuclear beta decay in which it is necessary to take into account final (or initial) state Coulomb interactions. Because of the similarity of the wave functions to those of a free particle, calculations including rigorously all Coulomb corrections for such processes as allowed beta decay can be performed with little more effort than is involved in a calculation using only plane waves. (auth)

Tritium and Tritium Compounds

9542 WADC-TR-56-623

United States Radium Corp., New York.

DEVELOPMENT OF A TRITIUM IMPREGNATED METAL FOR USE AS THE ACTIVATOR IN A SELF-LUMINOUS PHOSPHOR AND FOR USE AS AN IONIZATION SOURCE. [Period covered] May 15, 1955 to September 15, 1956. D. L. Prosser, C. H. Wright, J. E. Atherton, J. G. MacHutchin, and H. H. Dooley. Nov. 15, 1956. 79p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: LUMINESCENT PHOSPHORS. Contract AF33(616)-3036. (AD-131030).

A description of the methods and equipment used in the preparation of tritiated foils is presented. The results of the experimental studies indicate that maximum beta emission is obtained from extremely thin layers of titanium tritide which have been prepared on the surface of sand-blasted stainless steel backing foils. Phosphor response studies have indicated that the main factors effecting the response of ZnS type phosphors to tritium beta radiation are (a) phosphor particle size (b) type and concentration of activator and (c) cadmium content. Six research models of tritium foil-activated self-luminous sources have been prepared for submission to WADC. A description of the research models is provided. (auth)

Uranium and Uranium Compounds

Refer also to abstracts 9209, 9434, 9436, 9437, 9438, 9440, and 9445.

9543 SEP-246

Sylvania Electric Products Inc. Metallurgical Research Lab., Bayside, N. Y.

DIMENSIONAL INSTABILITY OF URANIUM—II. Second Annual Progress Report, January 1, 1956 to June 30, 1957. R. Resnick, L. S. Castleman, and L. Seigle. Feb. 15, 1958. 14p. For Sylvania-Corning Nuclear Corp. Contract AT-30-1-GEN-366. $0.50(OTS).

The mechanism of dimensional instability of irradiated uranium is under investigation. In order to confirm an assumption of the diffusion theory, the magnitude of diffusion anisotropy in alpha-uranium single crystals is being determined by measurement of the diffusion coefficients along the principal directions. Progress made in working out procedures for the preparation of uranium single crystals, preparation of the diffusion couples, measurement of valid

concentration-penetration data in very thin diffusion zones by sectioning, and measurement of surface concentrations by means of nuclear tracking emulsions is discussed. Also, in-pile experiments are being designed to further clarify the nature of growth under irradiation. (auth)

9544

THE CHEMICAL BEHAVIOUR OF Mo^{99} FORMED ON NEUTRON IRRADIATION OF URANIUM COMPOUNDS. L. V. Shiryayeva and G. M. Tolmachev. Atomnaya Energiya 3, No. 10, 318-20(1957).

U_3O_8 and UO_2 (5 to 50 g) were for 1.5 hr heated to temperatures of from 400 to 1200°C, after irradiation with neutrons, in oxygen and hydrogen. The yield of Mo^{99} was measured. For U_3O_8 the yield of Mo^{99} depends mainly upon the annealing temperature but not upon the nature of the gas. The transformation of U_3O_8 into UO_2 has no influence upon the Mo yield on the occasion of the heating of U_3O_8 in hydrogen. During heating of U_3O_8 in oxygen T = 1200°C) about 15% Mo^{99} evaporates. In the case of hydrogen annealing no Mo^{99} evaporation was observed in the total temperature range. If UO_2 is annealed in hydrogen, the Mo^{99} yield increases at higher temperatures and attains 11% at 1200°C. In the case of annealing in oxygen, however, the Mo^{99} yield at 1000°C attains a maximum of 83.5%. At 1200°C 40% of the total Mo^{99} evaporates. If this sample is then treated with certain liquids, 57% evaporates. It does not seem wrong to assume that a certain part of Mo^{99} is produced in the form of MoO_3 on the occasion of fission. (TCO)

9545

THE TOTAL γ-ACTIVITY OF U-235 FISSION PRODUCTS. V. N. Sakharov and A. I. Malofeyev. Atomnaya Energiya 3, No. 10, 334-5(1957).

The γ activity of U^{235} fission products is compared with the γ activity of a simultaneously irradiated Na^{23} target by means of a γ counting tube which is equally sensitive within a wide γ energy range. Irradiation took place in the Russian D_2O reactor. The order of magnitude Q(t) (summated activity) is calculated. (TCO)

9546

THE URANIUM CONTENTS OF IRON METEORITES. G. W. Reed, H. Hamaguchi, and Anthony Turkevich (Argonne National Lab., Lemont, Ill. and Univ. of Chicago). Geochim. et Cosmochim. Acta 13, 248-55(1958).

Seven iron meteorites and the iron phase of one pallasite have been examined for uranium content by neutron activation. The results are at the limit of detection by this method under the conditions used, but indicate a variable uranium content in the range 10^{-12} to 10^{-10} g/g. This agrees with the limits set by Reed and Turkevich (1955) in preliminary results of the application of neutron activation to this problem, and is more than a factor of 10 lower than previous determinations by other methods. (auth)

9547

STEAM SINTERING OF URANIUM DIOXIDE. C. Arne Arenberg and Paul Jahn (Illinois Inst. of Tech., Chicago). J. Am. Ceram. Soc. 41, 179-83(1958) May.

The following variables were considered in an investigation of the sintering of uranium dioxide: (1) sintering aids, i.e., small additions of substances that might aid the densification process, (2) soaking temperature, (3) soaking time, (4) furnace atmosphere, and (5) particle size of the uranium dioxide. The incipient sintering temperature, the effect of binders, and the effect of fabricating pressure also were determined. The data obtained in the investigation led to the following optimum conditions for obtaining dense UO_2 by cold pressing and sintering: (1) preparing the UO_2 as a submicron powder but not fine enough to be pyrophoric, (2) cold pressing at 20 to 30 tons per sq. in. without the use of organic binders, (3) using the following sintering schedule: (a) in H_2 to 1400°C, (b) in steam or a wet inert gas from 1400 to 1500°C, (c) in steam or a wet inert gas at 1500°C for a 1-hour soak, and (d) cooling in H_2 from 1500°C to room temperature. By following this procedure, pellets of UO_2 (⅜ in. in diameter by ¼ in. high) were obtained that were 97 to 98% of theoretical density. (auth)

9548

MEASUREMENTS OF THERMAL UTILIZATION, RESONANCE ESCAPE PROBABILITY, AND FAST EFFECT IN WATER-MODERATED, SLIGHTLY ENRICHED URANIUM AND URANIUM OXIDE LATTICES. D. Klein, A. Z. Kranz, G. G. Smith, W. Baer, and J. DeJuren (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 3, 403-27(1958) Apr.

Measurements of thermal utilization, resonance escape probability, and fast effect have been made in 1.3% enriched uranium metal and uranium oxide fueled lattices. Parameter measurements were made in oxide lattices of fuel densities 7.53 g/cc and 10.53 g/cc. Experimental results were obtained in lattices having 0.600-inch and 0.387-inch diameter rods at several water-to-uranium ratios. Values of the parameters have also been determined for two 1.15% enriched metal fueled lattices. (auth)

9549

MASS DISTRIBUTION OF FISSION PRODUCTS PRODUCED BY IRRADIATION OF GOLD AND URANIUM BY NITROGEN IONS. N. I. Tarantin, Yu. B. Gerlit, L. I. Guseva, B. F. Myasoedov, K. V. Fillippova, and G. N. Flerov. Zhur. Eksptl'. i Teoret. Fiz. 34, 316-21(1958) Feb. (In Russian)

The mass spectrum of fission fragments produced by irradiating thick targets of gold and uranium with 115 Mev nitrogen ions was investigated. Fourteen different elements were separated from the irradiated targets. The mass distribution curve for fission fragments produced by irradiating gold has the form of a narrow peak with a half width of about 20 mass units. The maximum of the peak is at Ar ~100. The width of the mass distribution curve for fission fragments of irradiated uranium is much larger. (tr-auth)

9550

INVESTIGATION OF γ-RAYS EMITTED IN THE FISSION OF U^{235} INDUCED BY 2.8 AND 14.7 Mev NEUTRONS. A. N. Protopopov and B. M. Shiryaev (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 34, 331-3(1958) Feb. (In Russian)

The γ rays coinciding in time with fission fragments were recorded with a scintillation counter. It is shown that the γ-ray spectrum is the same for U^{235} fission induced by 2.8 and 14.7 Mev neutrons as for fission induced by thermal neutrons. It is concluded that the total γ-quantum energy per U^{235} fission event induced by 2.8 and 14.7 Mev neutrons is the same to within 15% with that for thermal neutron induced fission. (tr-auth)

PATENTS

Chemistry

9551

EXTRACTION OF URANIUM FROM ITS ORES. T. V. Arden, F. H. Burstal, and R. P. Linstead (to U. K. Atomic Energy Authority). British Patent 785,602. Nuclear Eng. 3, 228(1958) May.

Uranium having a very low phosphate content is extracted from phosphatic ores by treatment with concentrated sulfuric acid. A system is formed comprising a liquid sulfuric acid–phosphoric acid phase and a solid

phase containing all or the greater part of uranium content of the ore and the solid phase is then separated out by centrifugal means. The solid phase obtained is taken up with water and treated with a soluble barium salt and filtered.

9552

CHEMICAL REACTIONS. (to Esso Research and Engg. Co. (U.S.A.)). British Patent 785,611. Nuclear Eng. 3, 228(1958) May.

The steady accumulation of radioactive by-products or waste materials in the operation of atomic piles presents a disposal problem. The difficulty can be alleviated by using the material for certain reactions. The radioactive material is maintained in the lower portion of a ground excavation under a shielding material. The reactant material is introduced or kept in the lower part of the excavation sufficiently close to the radioactive material to allow the radiation to reach the reactants. It is preferred to expose the reactants to radiation emitted by the fission by-products of processes generating atomic power and/or fissionable materials. The activation of chemical reactions by high-energy ionizing radiation is somewhat complicated by the fact that most reactions are between elements of low atomic number (21 or lower), which do not effectively absorb, e.g., gamma-rays. Such mixtures can be sensitized by incorporating elements of high atomic number (22 or greater; preferably 74), such as mercury in the form of a solution, suspension or emulsion or as mercury vapor in a hydrocarbon mixture. Ultrasonic vibration may be introduced to obtain more uniform or more stable emulsions or suspensions. Instead of elements of high atomic number, compounds may be used. The additions may range between 1 and 5% of the reactants. The method may also be applied to chain reactions which involve the production of free radicals. Water may be maintained in the pit as a transparent shield over a thin layer of concrete covering the concrete or metal-lined pit.

9553

PROCESS FOR THE PREPARATION OF FLUOROCARBONS. (to U. K. Atomic Energy Authority (U.S.A.)). British Patent 785,641. Nuclear Eng. 3, 228(1958) May.

A method is described of catalytic fluorination of hydrocarbons by which high yields exceeding 50% fluorinated product can be obtained. Fluorine and the organic compound in the vapor phase are mixed in the presence of a catalyst at a temperature of 100 to 400°C.

9554

METHOD OF THE RECOVERY OF URANIUM PRODUCTS FROM SOLUTIONS CONTAINING HEXAVALENT URANIUM. (to A. B. Atomenergi (Sweden)). British Patent 785,997. Nuclear Eng. 3, 228(1958) May.

This method consists in dissolving in an aqueous solution containing hexavalent uranium one or more amides to form a homogeneous solution, and heating the solution to cause the amide to hydrolyse whereby the pH value of the solution increases and ammonium uranate is precipitated. This precipitate can easily be separated by filtration or centrifuging. As a rule, a carbamide is the preferred amide as it provides a quicker and more complete precipitation. The product easily falls to a powder of a uniform grain size so that no grinding or screening is necessary.

Engineering

9555

HEAT EXCHANGE SYSTEMS. A. Bell (to Foster Wheeler, Ltd.). British Patent 785,862. Nuclear Eng. 3, 228(1958) May.

A shell and tube heat exchanger is described for the heat exchange between a first fluid and a second fluid where it is important that the two fluids should not come into contact. The most likely point for leaks to occur is at the joints between the tubes and the tube plates. Double tube plates are used, and the space between them is supplied with a gas or vapor inert to either fluid under a pressure equal to that of the liquid. An expansion tank may be arranged in accordance with B.P. 772,765, and a leak detector may be connected to the space between the tube plates.

Mineralogy, Metallurgy, and Ceramics

9556

IMPROVEMENTS IN OR RELATING TO THE CANNING OF METALS. (to United Kingdom Atomic Energy Authority). British Patent 790,334. Feb. 5, 1958. Nuclear Power 3, 254(1958) May.

So that fuel cans can be made of metals which form compounds or alloys with the fuel element at temperatures below 800°C, it is proposed to coat the element with a thin layer of niobium. This gives adequate heat transfer and avoids metallic interaction. The layer is formed either on the element itself or on the can by electrodeposition, decomposition of a niobium compound vapor, by metal spraying, etc. Alternatively niobium foil can be wrapped round the element. Suitable layer thickness is 1 to 2 mils. After assembly and sealing, the can is subjected to pressure as usual to ensure can/niobium and niobium/element contact.

Physics

9557

NUCLEAR REACTOR PLANT. (to Allmänna Svenska Aktiebolaget (Sweden)). British Patent 785,528. Nuclear Eng. 3, 228(1958) May.

In order to reduce the otherwise required great thickness of a pressure vessel enclosing reactors for large power, and, therefore, of large dimensions (thicknesses of 20 cm have been mentioned in the literature), the reactor is inserted into a space formed in rock so that the rock, preferably provided with a thin smoothing layer of concrete, takes up the pressure stresses to which the walls, bottom and top of the reactor vessel are subjected. Water may also be used as pressure transmitting medium between reactor vessel and rock wall. The vessel can then be constructed with comparatively small thickness. Used fuel elements are removed and new elements inserted through a vertical mounting shaft. Expansion stresses are avoided by keeping the vessel at low and constant temperature by cooling. The vessel may also be provided with an inner thin corrugated wall filling the space between both walls with cooling water under the same pressure as the pressure vessel. Or resilient joints may be arranged between suitable parts. Sliding movement between rock wall (concrete) and vessel may then be facilitated by interposition of a thin cover sheet. Or the vessel may be positioned freely in the rock space, the interstice then being filled with a medium of the same pressure as the internal pressure in the vessel.

9558

NUCLEAR REACTORS INCLUDING HORIZONTAL GRAPHITE BARS. (to Commissariat a l'Energie Atomique (France)). British Patent 785,928. Nuclear Eng. 3, 228 (1958) May.

Resilient springs are interposed between the surrounding structure and the graphite blocks so as to fix them firmly

in the desired position, but permit expansion. The resilient means must be strong enough to overcome the friction between the blocks of each row and those of the adjoining rows. Vertical gaps between the rows are maintained by struts of low neutron absorption. These struts are located at points common to three graphite bars in order to reduce their number to a minimum.

9559

RADIATION DETECTING DEVICE. P. W. Martin and R. W. Pringle. British Patent 786,194. Nuclear Eng. 3, 228(1958) May.

The exploration unit operates with a scintillation crystal, a large mass of sodium iodide activated with thallium, converting gamma rays into light scintillations. The crystal must be kept cool and dry to work properly. As the detector is to be used for the remote exploration of underground oil-bearing formations a multi-compartment cell structure is used with outer walls of low thermal conductivity. One of the compartments contains the means responsive to radiation bombardment, e.g. gamma rays, another one is a cooling medium and the compartments are interconnected to establish a heat exchange flow between them.

9560

IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR USE IN NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). British Patent 790,389. Feb. 5, 1958. Nuclear Power 3, 254(1958) May.

This is a modified Calder type fuel element, designed to reduce cumulative stretching of the can. On heating, the can expands longitudinally more than the fuel element and on cooling, friction prevents the free contraction of the can. Repeated thermal cycling increases the stretch cumulatively, results finally in fracture. To prevent this, a series of grooves are machined in the element—thirteen in all—and the can driven into them by pressurization. This is achieved by placing the sealed element in a pressure vessel filled with dry CO_2 at 100 psi and heated uniformly to 500°C over a period of three hours. This causes a pressure rise to 350 psi, maintained for four hours, and controlled cooling then takes place over a further three hours.

9561

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. W. E. Dennis and P. A. Lindley (to General Electric Co., Ltd.). British Patent 791,011. Feb. 19, 1958. Nuclear Power 3, 254(1958) May.

A unique feature of the GEC Hunterston power station is the use of what the firm call the 'replaceable channel fuel element' and the patent covers the idea. The actual metallic element is generally similar to those used in other power stations—a uranium bar sheathed in a helically-finned can—but it is supported inside a sleeve of graphite or other material. The composite elements are stacked inside channels through the core and are charged and discharged as complete units. The advantages claimed are: the core channels are protected against mechanical abrasion during fuelling operation, the moderator is protected against chemical attack and mass transfer from the coolant, and if there is a burst slug it is only the sleeve which is contaminated. The sleeve also takes all the weight, thus elements are uniformly stressed. Working on this idea, the specification covers several variants, including the use of plate-type elements.

9562

FUEL ELEMENT FOR NUCLEAR REACTORS. (to Physikalische Studiengesellschaft, Dusseldorf). British Patent 792,170. Mar. 19, 1958. Nuclear Power 3, 254 (1958) May.

In power reactors the formation of Pu^{239} on a large scale is often undesirable. Also as the capture cross section of uranium for medium-fast neutrons is greater than for thermal ones, neutron losses occur at the fuel element surface. To overcome these disadvantages the inventors propose coating the uranium with thorium. Th^{232} also has a very large absorption cross section for medium-fast neutrons, but decays to U^{233} which has a higher neutron yield than Pu^{239}, even with slow neutrons. The reactivity of the whole element may be maintained constant by preferential and controlled formation of U^{233} or may even be increased during operation as required. The element may take any of a number of shapes and is not limited to using metallic uranium and thorium.

9563

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. J. le Foll and G. Melese (to Commissariat a l'Energie Atomique). British Patent 792,171. Mar. 19, 1958. Nuclear Power 3, 254(1958) May.

In a gas-cooled reactor the heat output is proportional to the neutron flux and is therefore highest near the center of the core, decreasing radially outwards to the periphery. Higher rated channels are limited by the maximum temperature in the uranium, and in peripheral channels the limit is set by the maximum permissible can temperature. In an intermediate zone both factors have to be taken into account. There is an optimum thermodynamic condition for each channel and to obtain this, dividing the channels into annular groups is proposed. In a particular application—which seems to be similar to the arrangement used in the Marcoule reactors—there are three annular inlet zones supplied from concentric manifolds. Temperatures are 50, 150, and 200°C reading radially outwards. Inlet pressure is the same in each (200 psi). On the outlet side there are two annular manifolds to each inlet one and the flows are mixed by jet pumps.

PERSONAL AUTHOR INDEX

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